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**THE EFFECTIVENESS OF AN INTERVENTION TO IMPROVE VEHICLE SAFETY FOR  
CHILDREN**

**By**

**Lisa Anne High**

**A Thesis**

**Submitted to the Faculty of Graduate Studies and Research through the Faculty of Nursing in  
Partial Fulfillment of the requirements for the Degree of Master of Science at the University of  
Windsor.**

**Windsor, Ontario, Canada**

**2005**

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## ABSTRACT

Motor vehicle crashes (MVC's) are the leading cause of death and serious injury among children 14 years and younger (Murphy, 1998; Zaza et al., 2001). The consistent and proper use of child restraint systems has been estimated to be over 74% effective in the reduction of serious injury and death in children traveling in motor vehicles (Biagioli, 2002; Weber, 2002). Biagioli (2002) reported that while many parents know car seats are important more than 80% of car seats are misused and parents often are unaware of their misuse of CRD's. The purpose of this research was to investigate the effectiveness of a parent focused intervention on parents knowledge of correct car seat use for children 0 months of age to 10 years of age.

A pre-test post-test quasi-experimental design was used to test the effectiveness of a parent focused intervention. The parent focused intervention included a multi-media education program using a variety of learning strategies. For this multi-media education program, parent participants used a self-directed approach. Study results indicated a significant increase in parental knowledge of correct car seat use based on the indicators of age, height and weight regarding key transition times: rear facing to forward facing car seats, forward facing to booster seats and booster seats to seat belts. The results of this research study definitely show that a multi-media intervention program impacted parental knowledge in a very positive manner.

## DEDICATION

To my best friend and husband, Brent who has always believed in me, and who always made sure I had time to myself for my education. To Mitchell and Davis, my boys who have patiently understood my need to pursue my career goals.

## **ACKNOWLEDGEMENTS**

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## Chapter 1

The Effectiveness of an Intervention to Improve Vehicle Safety for Children*Introduction*

Health care professionals, all too frequently see the tragic results when parents fail to properly secure children riding in motor vehicles (Berns, et al., 2001). "Riding in motor vehicles is the most dangerous thing children can do, causing more death and disability than any other activity" (McKay, 2003, p. 1). Motor vehicle crashes (MVC's) are the leading cause of death and serious injury among children 14 years and younger (Murphy, 1998; Zaza et al., 2001). The World Health Organization (2004) (WHO) suggests that the estimated number of road deaths is approximately 1,183,492 annually, which "represents over 3000 lives lost daily" (p. 4). In the last 50 years, more people have perished on Canadian roadways than the total number of Canadians killed in both world wars (Transport Canada, 2002).

In 2002, an estimated 180,571 children under the age of 14 years died from MVC's (World Health Organization, 2002). An estimated 228,000 children age 14 and under were injured as occupants in motor vehicle crashes in 2001 (Injury Facts, 2001). Annually, approximately 10,000 Canadian children, 12 years of age and younger, are injured and some of these children die as a result of MVC's (Transport Canada, 2002).

MVC's are producing a significant drain on health care services. Hanfling, Mangus, Gill, and Bailey (2000) have stressed that "besides the increased emergency medical services necessary to treat trauma victims, there is also a need for rehabilitative health services to treat long term disability from the injury" (p. 125). In addition, the emotional costs associated with the death or permanent disability of a child are immeasurable. The outcome of MVC's "can place a heavy burden on family and friends of the injured

person, many of whom experience adverse social, physical and psychological effects, in the short-term or long-term” (WHO, 2004, p. 50). Health Canada (2002) has indicated the “economic burden of unintentional (e.g., MVC, drowning, poisoning and fires) and intentional injury (suicide and violence) combined”(p. 4)... “costs the Canadian health care system \$12.7 billion annually” (p. 10).

Child occupants, in motor vehicles, are especially vulnerable to injury during a MVC. Child restraint devices (CRD's) provide specialized protection for children whose body structures are still immature and growing (Weber, 2000). In order to provide adequate protection to this population, correct seat, correct fit and correct placement are important for effective protection against injury (Berns et. al, 2001; Weber, 2000). The consistent and proper use of child restraint systems has been estimated to be over 74% effective in the reduction of serious injury and death in children traveling in motor vehicles (Biagioli, 2002; Weber, 2002). A reduction in the morbidity and mortality of young children is linked with the use of CRD's (Arbogast, et al., 2000; Biagioli, 2002; Johnston, Rivara & Soderberg, 1994; U.S. Department of Transportation, 1998; Weber, 2000).

Chronological age has too often been used as the single indicator for transition of children from one child safety device to the next. Whereas, growth and development parameters such as height and weight should be the primary factor as children grow and develop at different rates and stages. As children grow and develop, fewer are appropriately restrained when riding in motor vehicles (Bull et al., 2002; Weber 2002; Winston, Durbin, Kallan & Moll, 2000). Numerous studies suggest that misuse begins as early as 1 year of age (Gielen, Erikson, Daltroy, & Rost, 1984; Ramsey, Simpson, & Rivara, 2000; Winston et al., 2000). Recognizing that growth and development patterns

of children are the key to safe and effective use of CRD's is the primary factor in ensuring children are safe during motor vehicle travel.

### *Study Purpose*

Today in North America, approximately 80% of CRD's are not being used correctly, thus children remain unprotected and susceptible to serious injuries and even death when traveling in vehicles (Biagioli, 2002). Research indicates as many as two thirds of children traveling in motor vehicles are not restrained appropriately leaving them vulnerable to serious injury and death (Margolis, Wagenaar, & Molnar, 1992). The most effective strategy for reducing injury and fatalities from MVCs' is the consistent and proper use of the CRD, as well as avoidance of early transition of a child into the adult seat belt safety system. Although the literature has suggested that some protection is afforded by child safety seat use, maximum efficacy is only realized through the appropriate use of the CRD's based on growth patterns of height and weight (Berns et al., 2001; Bull, Bruner, Stroup & Gerhart, 1988; Weber, 2000).

Health care professionals need to provide up-to-date, appropriate information for parents and caregivers regarding car safety seat choices, appropriate transition times for the child from one CRD to the next, and the proper use of CRD's. Achieving a credible health and safety approach to increase the awareness of the appropriate use of child restraint systems for Canadian families is clearly needed.

The primary responsibility of parents and/or caregivers is to protect young children while transporting them in a motor vehicle. Appropriate use of CRD's based on the child's weight and height are the first essential steps in providing protection for children in vehicles. Biagioli (2002) reported that while many parents know car sets are important

more than 80% of car seats are misused and parents often are unaware of their misuse of CRD's (Block et al., 1998).

The purpose of this research was to investigate the effectiveness of a parent focused intervention on parents knowledge of correct use for children 0 months of age to 10 years of age. The research hypotheses were:

Hypothesis 1: parental knowledge of the correct CRD for the child's weight and height will increase following the intervention program

Hypothesis 2: parental knowledge about the correct fit of the child in the CRD will increase following the intervention program

## Chapter 2

### Review of the Literature

#### *Introduction*

One of the major health risks for children in North America is motor vehicle trauma. The effective use of child restraints has been shown to reduce injuries in the event of a MVC (Johnston, Rivara & Soderberg, 1994; U.S. Department of Transportation, 1998). The National Committee for Injury Prevention (1989) described how the proper use of child restraint protection systems, that is, child car safety seats and vehicle seat belts, had the potential to reduce injuries by 67 percent and deaths by 71 percent. Weber (2002) has since found that when safety restraints are used properly, serious injury and death can be reduced by as much as 74%. Despite parents knowing that child safety seats are important, more than 80% of car seats are still misused (Biagioli, 2002). Misuse of CRD's remains pervasive in Canada resulting in injury and death due to MVCs' as a leading cause death for children in Ontario.

#### *Injury Outcomes in Children*

The leading cause of trauma related hospital admissions in North America is motor vehicle crashes (MVCs) (Sahai, Pitblado, Bota & Rowe, 1998). MVC's are the leading cause of death and acquired disability for children older than 1 year of age (Gielen et al., 1984; Ramsey et al., 2000; Winston et al., 2000). Over the past 30 years, childhood trauma from MVCs' has remained unchanged, and 50 percent of all childhood deaths are attributed to trauma related injuries (Block et al., 1998; Patterson, 1999).

The primary goal of safety restraint systems is to protect the central nervous system, of the occupant, in the motor vehicle from being injured (Weber, 2000). Soft tissue damage and broken bones heal, but damage to the brain and spinal cord are life

threatening and often irreversible (Weber, 2000). For children, intra-abdominal organs are less protected than that of an adult because protective bony structures such as the pelvis, the bony thorax and the iliac crests are not sufficiently developed to adequately serve as anchor points for seat belts designed for adults. The seat belt tends to ride up over the soft part of the abdomen when used by children (Statter & Vargish, 1998). A child does not fit an adult seat belt until approximately 8 years of age, when the child's femur is long enough for the child to sit against the back seat of the motor vehicle, and the anterior superior iliac spines are sufficiently developed to effectively anchor the seat belt (Winston et al., 2000). Thus, children younger than 8 years of age are not often safely restrained in seat belts.

The second goal of safety restraints is to limit and control the rate of the body's overall deceleration during a vehicle crash (Weber, 2000). Controlling movement of vehicle occupants during crashes reduces the forces acting on the body's surface, which minimizes the differential motion between the skeleton and the internal organs (Weber, 2000). Rapid deceleration of the body and impact of vehicle structure on body surfaces are both associated with severe injury during vehicle collisions. The objective of restraints is to create a tight coupling to the crushing vehicle along with distributing the remaining load as widely as possible over the body's strongest anatomical structures (Weber, 2000).

The effectiveness of safety restraints is absolutely dependant on the appropriate CRD for the child and the correct anchorage of the CRD ensures the best protection of the child during a MVC. The appropriate use of CRD's for children includes: (a) the correct seat for the age, height and weight of the child; (b) correct placement of the seat in the



vehicle; (c) correct installation of the CRD in the vehicle interior; and (d) the correct use of the devices straps, harnesses, clips and buckles (Bull, Agran, Garcia & Gardner, 2002). When children are fitted correctly in the child restraint system, the force of the crash is spread over the hard bony structures of the body, which allows for better protection from injury (Morris et al., 2000; Weber 2000). A child is 2.7 times more likely to endure the crash without serious or fatal injury when CRD's are properly fitted to the occupant's body frame than an unrestrained child (Berg et al., 2000; Weber, 2000).

To achieve tight coupling to the crushing vehicle, correct seat, correct fit, correct use of the straps, harnesses and buckles, as well as correct installation, optimizes the body's impact tolerance, which leads to a more protective outcome for the child. However, if any one of these requirements is not met, the potential risk for injury and death increases, particularly for children. Failure to do so is commonly referred to as "misuse."

Misuse of child restraint systems can lead to devastating injuries for the child occupant. Injury can potentially result from the misuse of a number of CRD components such as: not locking the clip; non-use of the harness retainer clip; non-use of the harness straps; non-use or misuse of the tether straps; and failure to secure the UAS clip or properly route the vehicle seat belt through the frame of the car seat. Misuse of any of these components can result in situations in which the child could be thrown from the seat or the seat could become a projectile object in a crash (Block et al., 1998; Bull et al., 1988; Morris et al., 2000; Stokes et al., 2000). "Injury to the child is most often caused by secondary impact with the vehicle interior, another passenger, the road, or other nearby objects [e.g., trees, light post]" (Stokes et al., 2000, p. 867). Impacts such as these account for the majority of deaths of children in MVC's. The most frequent, serious,

nonfatal injuries have debilitating outcomes in children involved in MVC's that are a direct result of brain and spinal cord damage (National Safe Kids Campaign, 1997).

"Seat belt syndrome" and/or "jack-knifing" are two interchangeable terms, which are used by health care professionals in tertiary care centers, to describe serious injuries that children endure as the result of MVC. In MVC's, children using ill-fitting child restraints or adult seat belts can suffer from serious abdominal and spinal cord injuries, termed seat belt syndrome (Lane, 1994). Seat belt syndrome encompasses a group of common and life threatening injuries such as: lacerated liver, lacerated bowel or spleen, a ruptured bladder, and internal bleeding (Lane). Seat belt syndrome is a direct result of jack-knifing. Jack-knifing occurs during the crash when the head meets the knees of the child increasing the prevalence of head injury. As the body is propelled forward during this jack-knifing process it causes serious intra-abdominal, spinal cord, and head injuries (Winston et al., 2000).

One of the most common factors associated with serious injury in children is the premature graduation from CRD's to seat belts. Lap-shoulder seat belts are considered dangerous when utilized for children before they reach 145 centimeters (57 inches tall), a weight of 36 kilograms (80 pounds), and a sitting height of 74 inches (29 inches) (Berns et al., 2001; Klinich, Pritz, Beebe, Welty, & Burton, 1994; Weber 2002). Injuries sustained by young children restrained in adult vehicle seat belts during a MVC are usually disabling and/or fatal (Berg et al., 2000).

The literature strongly suggests that child safety seats and booster seats provide more effective protection for children than adult seat belts. In one study, researchers found that young children between the ages of 2 and 5 years who used seat belts were 3.5 times

more likely to suffer significant injury and 4 times more likely to endure significant head injury as well as significant abdominal injuries (Winston et al., 2000). Decina and Knoebel (1997) found that when a child is moved into an adult seat belt prematurely, there is an increased risk of neck injury and damage to the internal organs.

Canadian Motor Vehicle Traffic Collision Statistics (2001) showed that the age group 0 to 4 years of age revealed 32 fatalities and 3,148 injuries, and 5 to 14 year olds revealed 120 fatalities and 13,514 injuries. One of the compelling features of the Canada Transport data is the difference in outcomes for younger children (0 to 4 years) compared to older (5 to 9 years) children. Clearly, children 5 to 14 years of age have four times greater prevalence of injury outcomes than their younger counterparts age 0 to 4 years. This group was also the lowest overall of the age groups to have the appropriate restraint system usage. Although current data indicates, over 80% of children ages 3 to 9 were restrained in motor vehicles, injury outcomes increased dramatically with the age of the child (Transport Canada, 1998).

The leading cause of morbidity and mortality in children continues to be the result of vehicle occupant trauma (Block, et al., 1998). A review of the literature suggests that there are several gaps regarding the state of knowledge concerning the safety of our children while riding in motor vehicles. Injury outcomes from MVCs' is well documented, advanced technology and medical practice to care for trauma victims is unremarkable. Yet, the health care system today does not have a universal systematic approach that examines fully safety system use during MVCs. For example, when a child is received in the Emergency Department there is no universal screening or data collected about the type of safety system used for vehicle occupants (or misused), nor the location

of the occupants in the vehicle. Comprehensive assessment of restraint use during MVC's could assist health care providers in developing effective education and prevention programs.

### *Patterns of Utilization*

The majority of children who graduate from infant car seats are inadequately restrained in motor vehicles (Morris et al., 2000; Ramsey et al., 2000). Misuse, represents the majority of the child population who ride in motor vehicles. General types of misuse include: (a) using the wrong car seat for the child; (b) improper car seat installation into the vehicle; and (c) poor fit of the child in the car seat which refers to inappropriate use and positioning of straps, harnesses, buckles and tethers.

National data illustrates very worrisome evidence of misuse of safety systems for children. According to a 1999 national survey, 90% of drivers and occupants use vehicle restraints (Transport Canada). Provincially, survey data revealed that 73% of children under 1 year of age were properly restrained, 71% of children 1 to 4 years of age were properly restrained and 99.7% of children 5 to 9 years of age were properly restrained and 100% of 10 to 15 year olds were properly restrained (Transport Canada, 1998).

Chouinard and Hurley (2005) have suggested that "the rate of unrestrained children was last measured in Canada in 1997 in a roadside survey, and was around 13%" (p. 6). The critical, yet missing component of this particular 1997 survey data was that weight and height was not used as an indicator to determine appropriate restraint use. What is important to recognize from this data is the definition of the term "appropriate restraint."

The operational definition of appropriate restraint used for the collection of the Transport Canada data statistics was child seat, booster seat or seat belt for children age 3 to 4 years

old and a booster seat or seat belt for children age 5 to 9 years of age (Transport Canada, 1998). Another limitation of this data is the exclusive focus on age rather than the much more appropriate indices of height and weight to determine correct use. More recent guidelines recommend that the appropriate vehicle restraint utilized for children should be in accordance to the child's weight and height, rather than chronological age (Ramsey, et al., 2000; Winston et al., 2000).

The Ontario Ministry of Transportation (2001) identified that in recent child seat clinics held across Ontario, four out of five child car seats were installed or used incorrectly by parents. Patterns of misuse ranked at 90% of car seats inspected at car seat clinics held across Canada and the United States (Safety Council, 2000).

Data on child restraint use in Canada (1998) revealed that the "restraint usage was lowest for the 5 to 9 year olds" (p.3). Of the restraints used, 78.9% were restrained by an adult seat belt, 15.4% were totally unrestrained, and only 4.5% were in a booster seat (Transport Canada). The 5 to 9 year old age group was the lowest of all the age groups to have the appropriate restraint system used and are also the group with the highest incidence of morbidity and mortality (Transport Canada). A limitation with this data was that a child was considered to be properly secured when using only a seat belt (Transport Canada). In Canada, vehicle restraints have been mandatory by law since 1976 (Transport Canada, 1995). Child restraint devices, as well as infant car seats, carrying children up to 18 kilograms (40 pounds) are standard and required by law. However, the use of the pelvic restraint system (vehicle seat belt) by a child weighing over 18 kilograms (40 pounds) within a motor vehicles is considered legal (Ontario Provincial Offences, 1999) until the booster seat law taken effect September 1, 2005.

Another limitation of the Transport Canada data to date is the method of observation used, a “drive by” approach provides very limited accuracy in measures of safety system use. This “drive by” approach provides only a snapshot with very limited detail.

### *Misuse*

The most prevalent pattern of misuse involves the transition of children as they grow and develop from one CRD into an incorrect CRD, or to an adult seat belt. Specifically, many parents reported in the literature that they were confused about the appropriate weight and age of children who should be in booster seats, and incorrectly identified the age at which it was safe to use a lap-shoulder belt for their children (Rivara, Bennett, Crispin, Druger, Ebel & Sarewitz, 2001). The most common reason for lack of booster seat use was parental perception that their child was large enough to use a regular seat belt (Ramsey et al., 2000). Parental misconceptions about the appropriate restraint for their child’s height and weight was the most common reason children were not appropriately restrained (Decina & Knoebel, 1997; Morris et al., 2000; Ramsey et al., 2000).

Many health care providers and parents report uncertainty about the timing of the transition from a child safety seat to a booster seat (Berns et al., 2001). Most parents reported the discontinuation of their child’s car seat use at ages 3 to 4 years old (Berns et al., 2001). Studies have shown that shoulder belt use significantly increased with the age of the child and booster seat use decreased when there were three or more passengers in the motor vehicle (Ramsey et al., 2000). The majority of literature indicated that the most common reason for a child being in an adult seat belt was that the parents believed the child to be large enough to safely use seat belts (Morris et al., 2000; Ramsey et al.,

2000). Numerous studies have consistently demonstrated that seat belts are used prematurely for children at very young ages. Few children between 4 and 8 years of age were properly restrained for their age, and seat belt usage often begins as early as age 2 (Winston et al., 2000). Although the rates of safety systems utilization is quite high in Ontario, the efficacy of CRD's may be reduced by high rates of the incorrect seating system and premature use of seat belts (Transport Canada, 1997).

Another major area of misuse is the incorrect installation of the CRD in the vehicle. Estimates suggest that at least 33 percent of child seats are installed incorrectly and that more than 30 percent of toddler seats are installed without a tether strap, based on Transport Canada's 1997 observational data (Figures OPP, 1997). In recent child seat clinics held across Ontario, four out of five child seats were installed or used incorrectly (Ontario Ministry of Transportation, 2001). Numerous models and styles of restraint devices, accompanied by confusion with the how to place the device in the motor vehicle is related to parents feelings of uncertainty and frustration (Block, et al., 1998; Murphy, 1999; U.S. Department of Health and Human Services, 1998).

Sources of product information parents' use varies widely. For example, parents rely on sales personnel, family, and friends who all offer advice freely regarding child restraint systems. Research suggests that only 50% of parents actually read the product manual on how to secure the child car seat properly in the vehicle. When parents do read the product manual, the comprehension level and vocabulary often exceed the parent's ability to readily understand the information and follow the instructions (Block et al., 1998; Decina & Knoebel, 1997; Gaines et al., 1996; Huggins, 2003; Margolis, et al., 1992; Wegner & Girasek, 2003;). Product manuals are often difficult to comprehend,

and may contribute to misuse (Block et al., 1998). Block et al. also noted that families who obtain a second-hand safety seat reported that quite often instructions were not available. Studies by Bull et al. (1988) and Rivara et al. (2001) both reported that second-hand car seats often did not meet safety standards for use in vehicles.

Fit of the safety seat into the motor vehicle was another factor in parent's misuse. Parents expressed difficulty in fitting the CRD into the vehicle, fitting multiple seats into the vehicle and handling the bulkiness of the seats (Ramsey et al., 2000).

In today's society, there is an increase in multi-car families, which requires parents to move car seats from one vehicle to another. Often times grandparents or other caregivers are transporting children on a regular basis, thus the child car seat must be transferred repeatedly from vehicle to vehicle. When a child restraint device is moved frequently there is a higher percentage of misuse (Decina & Knoebel, 1997). Time and convenience of moving a child seat repeatedly from one vehicle to the other vehicle was identified as a contributing factor to misuse (Campbell, MacDonald, & Richardson, 1997; Ramsey, et al., 2000).

Parents describe their rationale for not using a child restraint device as child fussiness and discomfort (Decina & Knoebel, 1997). Non-users of child car seats have also reported the following reasons: the child did not like the seat, the seat is uncomfortable for the child, the child refuses to ride in the seat, car seats are inconvenient or difficult to use for the parents, and too expensive (Geilen et al., 1984; Neumann, Neumann & Cockrell, 1974; Verrealt, Stulginskis & Keyl, 1982).

Another common pattern of misuse addressed throughout the literature, was that many parents admitted to owning a booster seat but were not utilizing the seat (Ramsey et al.,



2000). Parents have expressed difficulty in making decisions about what booster seat to purchase as there are so many different brand/makes to choose from (Margolis et al., 1992; Ramsey et al., 2000).

To summarize, the barriers to proper use include the following: confusion about the appropriate weight and height for use of safety seats; lack of understanding of when to transition to safety systems; misuse of the CRD components; difficulty installing car seats; uncertainty and frustration about what car seat to purchase; child resistance and child fussiness when using safety seats; difficulty finding information on safety seat use; moving the car seat from one vehicle to another; and parents' belief that their children big enough to use a seat belt.

Clearly, the literature suggests lack of parental knowledge leads to misuse of child safety restraint systems and this continues to be a major challenge. The actual car crash itself may not be the only cause of injury to the child passenger, injury may be attributed to misuse of the child restraint system and/or the use of an adult seat belt. Improper use contributes to increased risks of injuries and death (Gaines et al., 1996).

### *Proper Use*

Child restraint system designs vary with the size of the child, the direction the child faces in the vehicle, the type of internal restraining system and the method of installation. However, when the child restraint system is properly used and secured, serious injury and death can be reduced by as much as 74% (Weber, 2002). Children grow and develop rapidly which requires safety restraint systems to change to fit a child's growth pattern. Thus, there are four appropriate transitions times with regard to the correct CRD, based on literature guidelines, which provide safety for children when riding in motor vehicles

(Berns et al., 2001; Weber, 2000).

The four appropriate transition times include: (1) an infant seat used for children from birth to one year of age or 9 kilograms (20 pounds); (2) a forward facing child seat for children from 9 kilograms (20 pounds) and up to 18 kilograms (40 pounds); (3) a booster seat for children from 18 kilograms (40 pounds) up to 36 kilograms (80 pounds); and (4) a vehicle seat belt is used when the child reaches 145 centimeters (57 inches) in height, weighs 36 kilograms (80 pounds) or more, and a sitting height of 74 centimeters (29 inches) (Berns et al., 2001; Ramsey et al., 2000; Weber 2000).

The importance of utilizing the correct seat for the child, based on the child's height and weight provides "coupling". Coupling is a process, which secures the child tightly to the vehicle allowing the child to safely "ride down" the crash. (Weber, 2000). The first step in achieving this coupling process is providing the correct seat for the child. The goal of safety restraints is to create a tight coupling to the crushing vehicle along with distributing the remaining load as widely as possible over the body's strongest parts (Weber, 2000). The next section will describe the equipment used at each transition time: the infant seat, the forward facing seat, the booster seat and the vehicle seat belt.

### *Infant Seats*

This type of restraint system is used for a child from birth to a weight of 8 kilograms (20 pounds) and at least to one year of age. The infant car seat is also referred to as the rear-facing convertible restraint and rear-facing only (Figure 1A and Figure 1B). The rear-facing restraint device is designed to be used as rear-facing only, whereas the rear-facing convertible restraint device is designed to be turned around and utilized as a forward-facing convertible which can accommodate a greater maximum weight.

“Beyond weight, the effective limit for either type is the seated height of the child, the top of the head should not be above the top of the restraint device to minimize the risk of head-contact and neck-compression injury” (Weber, 2000, p. 6). Therefore, if a child outgrows the infant car seat and the child’s height exceeds the top of the rear-facing only restraint device, he/she should be using a rear-facing convertible restraint device until a weight of 8 kilograms (20 pounds) is reached. Both types of infant seats need to be anchored to the motor vehicle with the vehicle seat belt or LATCH (Lower Anchors and Tethers for Children) attachments. The internal harness straps or straps plus a shield must be properly secured. Harness straps should always be at or below shoulder level and fit snugly to accommodate no more than one finger between the harness and the infant’s collar bone. If the infant seat has a chest clip, it should be placed at the level of the infant’s armpits. Harness straps need to be adjusted as the child grows for both safety and comfort. The infant seat should be installed in the center of the back seat of the motor vehicle away from air bags and the seat always faces to the rear of the motor vehicle.

### *Forward-facing Seats*

A forward-facing child restraint allows the child to face toward the front of the motor vehicle. There are two types of forward facing restraint systems: (1) Combination Child Restraint Booster, and (2) Forward facing convertible (Figure 2A and Figure 2B). The forward-facing child car seat is designed to accommodate children from 9 kilograms (20 pounds) to 18 kilograms (40 pounds) and a height of 102 centimeters (40 inches). There are two main steps to follow when using a forward-facing car seat: (1) correctly securing the child using the harness straps, and (2) correctly anchoring the seat securely to the

motor vehicle interior. The harness should be at the level of the child's shoulders or slightly below. Harness straps need to lie flat, all twists and wrinkles need to be removed as this will concentrate crash forces effectively (Weber, 2000). The chest clips should be at the level of the child's auxiliary area and be sure there is a snug fit created allowing only one finger between the harness and the child's collar bone. The restraint device should always be placed in the back seat of the motor vehicle and properly anchored to the motor vehicle. Anchorage is achieved by using the vehicle seat belt, to be sure the seat is tightly fitted to the vehicle, push the seat down into the vehicle upholstery and proceed to pull the vehicle seat belt as tight as possible allowing only 1 inch of movement or less.

### *Booster Seats*

Booster seats are used for children 18 kilograms (40 pounds) to 36 kilograms (80 pounds) and a height of 102 centimeters (40 inches). The primary objective of the booster seat is to assist in providing the correct anatomical fit of the seat belt to the child's physical frame (German, Gardner, Howard, Mackay and Letts, 1999; Winston et al., 2000). A booster seat is a type of car seat device designed to raise the child up to better facilitate the lap shoulder belt placement and provide support to the upper torso (Decina & Knoebel, 1997; Weber, 2000). There are two types of booster seats: (1) a low back booster, and (2) a high back booster (Figure 3A and Figure 3B).

Correct fit of the child to the booster seat is very important, the lap belt must be snugly positioned flat across the child's upper thighs and the shoulder belt crosses the center of the child's chest (Weber, 2000). Correct installation of the booster seat into the motor vehicle is a crucial step, therefore referring to the instructions that accompany the

booster seat as well as the vehicle manual are necessary to support in correct use.

### *Vehicle Seat Belts*

Vehicle seat belts are designed for adult passengers rather than children. Children are particularly vulnerable to injury during a motor vehicle crash as their bodies cannot tolerate the same force as that of an adult body (Decina & Knoebel, 1997). Therefore, a child should be placed into a vehicle seat belt only when he/she achieves a minimum weight of 36 kilograms (80 pounds) and height of 145 centimeters (57 inches) (Figure 4A).

Safety seat are not a substitute for a vehicle seat belt but rather an enhancement of the vehicle seat belt system to assist in providing protection for a child's smaller frame and weight until the child can safely uses vehicle seat belt. The fundamental goal of the different types of CRD's is to provide appropriate anatomic positioning of the vehicle seat belt around the child's physical frame to minimize occupant displacement and/or ejection during a crash (Berns et al., 2001; Weber, 2000). While it is safer to have a child ride in an ill-fitting seat rather than no restraint at all, many injuries have been associated with ill-fitting restraints (Winston et al., 2000). One of the major benefits of a child restraint system identified throughout the Winston et al. (2000) study was that "premature graduation of young children from a child restraint system to a seat belt puts them at greatly increased risk of injury in crashes" (p. 1179).

The importance of identifying the appropriate transition time leads to the correct choice of CRD and the correct CRD cannot be over emphasized, as this is the first step to providing adequate protection for children traveling in motor vehicles. Without the correct seat (CRD) for the physical weight and height of the child, putting a child in the

incorrect seat (CRD) with the correct fit and correct installation will only provide minimum protection, if not increase the risk for injury.

### *Legislation*

In Ontario, mandatory restraint laws have been in place and enforced since 1976. From 1976 to August 31<sup>st</sup>, 2005, the laws in place recognized that a child weighing 40 lbs can be restrained in a vehicle seat belt (Ontario Provincial Offences, 1999; Transport Canada, 1995), which does not provide the appropriate protection. However, effective September 2005, the physical requirements for vehicle seat belt use have recently changed requiring children to be either 80 lbs, or 8 years old in order to use a seat belt. The effectiveness of legislation on children's use of safety seats has not been examined in Canada.

In the United States the practice of primary enforcement of seat belt laws achieved significantly higher usage rates than States with secondary enforcement laws (U.S. Department of Transportation, 1998). It may be that enforced legislation is a positive motivator for restraint behavior. Canadian restraint laws are heavily enforced with high penalties such as fines and loss of points from the license system, which in turn influences the motor vehicle operators cost of insurance. However, a recent Canadian study revealed that seat belt use among back seat passengers was less than 60% with the majority of back seat passengers being children and youth (Safe Kids Canada, 2003).

### *Intervention Studies*

Throughout North America, Canada and the United States there have been several interventions and programs such as: Car Seat Clinics, Car Seat Safety Inspections Stops, Public Health Programs, Project Safe Kids, and Boost America, which have targeted

education and training for child care providers, teachers, health care providers as well as neighborhood and community organizations about vehicle safety for children. However, the difficulty with these types of interventions and programs is they often limit their focus on car seat inspection, which offers limited education for families. There is a need for the development of a universal education program with clear definitions of what appropriate use is based on a consensus from governments, law enforcement, health care providers, and automobile manufacturers so that the same message is consistent across the continuum.

There have been several interventional studies to date, which have tested and developed strategies to promote and teach motor vehicle restraint safety. An American intervention based study on CRD use observed parents placing their children in a CRD and into a motor vehicle in preparation for travel (Gaines, Layne & DeForest, 1996). A two-day training and education session for health care personnel was required to detect use error, to give information and education about correct utilization (Gaines et al., 1996). Health care personnel set up safety checks at various locations: day care centers, shopping malls, and health fairs. During the safety checks, health care personnel only described to the parents the errors noted in CRD use as they were not certified to physically correct the misuse themselves (Gaines et al). The types of errors reported included failure to stabilize the seat with the locking clip; misplacement of the vehicle seat belt across the child's neck or under the arm; child seated in the most hazardous location in the car; and, non use of restraints for their child (Gaines et al). What researchers learned from this study was that parents "will not master all the material after a simple reminder or even after one educational session" (Gaines et al., p.151). Study

findings suggested that restraint device use should be part of every health assessment as this may increase awareness of risk for parents and educational materials need to be simple, clear and accurate in text and illustrations would be beneficial.

A similar intervention study was recently carried out using home visiting nurses, where the nurses visited a number of rural and suburban homes and assessed CRD misuse through observation as mothers prepared their infant or toddler for vehicle transport (Block et al., 1998). In the study by Block et al., visiting nurses taught the mothers proper CRD use through verbal instruction and return demonstration using the family motor vehicle. The training for the visiting nurses involved extensive instruction regarding the use of CRD's and on the multiple models of CRD's available. Findings of this particular study revealed that: home visits provided by the visiting nurse took a longer amount of time than planned, three-quarters of the CRD's were incorrectly used, and one third of the mothers were aware of their incorrect use (Block et al). Neither of these interventional studies offered longitudinal data to measure the longevity of the skill and retention of information of the mothers (Block et al., 1998; Gaines et al., 1996).

In another study aimed at promoting motor vehicle safety through a five day educational program for preschoolers (Arneson & Triplett, 1990). The researchers noted that children generally were more knowledgeable after the educational program but the utilization of seat belts remained unchanged (Arneson & Triplett). This research also revealed that education alone is not enough to effect behaviour change in children (Arneson & Triplett, 1990). Consistent with another study, by Hazinski, Eddy and Morris (1995) concluded that a comprehensive school based program targeting Kindergarten to Grade Two students and their parents resulted in an increase in seat belt



use among children and their parents. The interventional studies to date have been predominantly based in the United States. Canadian intervention studies have not yet been documented in the current literature.

### *Clinical Significance*

The majority of the literature to date has primarily focused on the use, non-use and misuse of child restraint systems. One of the main themes in this research is the lack of parental knowledge regarding the transition times of child safety restraint use. Lack of parental knowledge entails not knowing the injury outcomes, not knowing what risks their children are placed in, and transitioning children to adult seat belts much too early based on chronological age as opposed to height and weight guidelines. Based on guidelines for growth and development of children, normal growth and development patterns indicate that most children do not meet the parameters for adult seat belt usage until 9 years of age and beyond (Wong, 1999). However, some research has documented that seat belt use begins as early as 1 year of age (Ramsey et al., 2001).

Research on misuse has been largely based in the United States, therefore caution must be exercised in making generalizations to the Canadian population. Although, Canadians share similar lifestyles', patterns of vehicle use and misuse vary significantly, which limits the generalizability of the American findings to Canadians (Gaines et al., 1996; Margolis et al., 1992). Use of the data from Transport Canada data is limited due to the operational definition used for appropriate restraint.

Selection and appropriate application of car safety seats is critical to maintaining child safety during transport in a motor vehicle. Most parents desire the knowledge to know which car safety seat is best for their children. Ramsey et al. (2000) identified that

promoting CRD use to school age children as well as educating parents about the hazards of using lap-shoulder belts is important.

Appropriate restraint use should be based on height and weight, not chronological age, therefore addressing only a single issue regarding child restraint safety measures is not adequate for children riding in motor vehicles. It is necessary to discuss transition times, which provides the parent and/or caregiver the information to make an informed choice which includes first and foremost the correct CRD. The first step to providing a safe environment for children riding in motor vehicles is the correct seat.

“Motor vehicle injuries are one of the most common causes of preventable childhood injuries and fatalities” (Stokes et al., 2000, p. 875). The objective of the health care profession should be to create effective strategies to reducing the injuries and deaths of children from MVC’s, by encouraging and educating parents about the need for consistent and proper use of motor vehicle child restraint systems. Therefore, this particular intervention study will focus on testing the effectiveness of an education program for parents that seek to prevent the devastating injury outcome of MVC’s for children traveling in motor vehicles. “The consistent and proper use of restraint systems by infants and children in passenger vehicles can prevent hundreds of deaths and thousands of injuries each year” (Weber, 2000, p. 20).

### Chapter 3

#### Theoretical Framework

##### *Human Adaptation Model*

The Betty Neuman Systems Model provided the theoretical framework for this research. The part of the model used focuses on health promotion to prevent the potential for injury, trauma, and death to children resulting from MVC's, from the inappropriate use or no use of a CRD.

The Neuman Systems model is an open systems model that focuses on the concept of wholism, which is based on two major components: stress and the reaction to stress. The wholism system approach is utilized to both protect and promote client stability (Neuman, 1995). Client stability implies a state of balance or harmony requiring energy exchange between the system and the environment to cope adequately with imposing and potential stressors, the goal of the client is to retain, attain or maintain system wellness. In this study, client stability refers to the "stability" or "safety" of a child in the environment of a motor vehicle in which children exchange energy and cope with the potential stressor of a MVC.

The format from Neuman Systems Model used for this research was "primary prevention as intervention" (Appendix A). Primary prevention as wellness retention, which means to protect the client systems usual wellness state by strengthening the flexible line of defense. The flexible line of defense acts as a "protective buffer system for the client's normal or stable state" (Neuman, 1995, p. 27). "The goal is to promote client wellness by stress prevention and reduction of risk factors, which includes strategies for health promotion" (Neuman, 1995, p. 33).

The Neuman model provides a theoretical framework for an educational intervention. In prevention as intervention, Neuman includes four concepts which focus on the goal of maintaining wellness: (1) stressors or possibility of stressors, (2) assessment of stressors to anticipate possible consequences of potential illness, (3) interventions to prevent invasion of stressors; and, (4) goal of strengthening the flexible lines of defense to maintain wellness which is also referred to as the basic core (Neuman, 1995). Therefore, this research was based on prevention as intervention and the following are 3 assumptions from the Neuman's systems model.

The first assumption states that "although each individual client or group as a client system is unique, each system is a composite of common known factors or innate characteristics within a normal, given range of response contained in a basic structure" (Neuman, 1995, p. 21). Each child's basic structure consists of biologic and physiologic systems, which are common to all children. The response to a MVC would be the potential for serious injury and even death for any child. Weber (2000) explains that the intra-abdominal organs in the body structure of a child is less protected than that of an adult as the bony structures such as the pelvis, the bony thorax and the iliac crests are not sufficiently developed to be anchor points in a crash, therefore it is necessary to protect it differently than that of an adult. Accident experience has also shown that a child's skull can be separated from its spine, and that the spine can be severed by the force of a crash (Fuchs, Barthel, Flannery, & Christoffel, 1989). The physical growth and development of children follows a general pattern based on physiological periods of maturity (Appendix B). In this study, there are common factors related to preventing children's injuries in motor vehicles: correct CRD, correct fit and correct installation. This

prevention is based on the four transition phases for correct choice of a CRD. Children grow and develop rapidly which requires safety restraint systems to change to fit a child's growth pattern. Thus, there are four transitions stages with regard to the correct CRD for the child, which provide a safer ride for children when riding in motor vehicles (Berns et al., 2001; Weber, 2000).

The second assumption is that there are "many known, unknown, and universal environmental stressors exist" (Neuman, 1995, p. 17). Each differs in its potential for disturbing a client's usual stability level, or normal line of defense. The particular interrelationship of client variables - physiological, psychological, socio-cultural, developmental, and spiritual - at any point in time can affect the degree to which a client is protected by the flexible line of defense against possible reaction to a single stressor or combination of stressors" (Neuman, 1995, p. 21-22). MVC's occur everyday, they are not planned events and this event could happen to anyone, anywhere, at any time, leaving no adult or child immune to this event. A MVC is a stressor which impacts the individuals inside the motor vehicle as well as the family members who are not, the Emergency Services Team, the Emergency room physician and nursing team members as well as members of the community. A MVC is a potential universal stressor for all children in society, being involved in a MVC there is the potential disruption to the usual wellness state or stability, which translates into injuries or death. The flexible line of defense is the first line of defense to help protect the child from possible outcomes of a MVC. Therefore, the goal is to strengthen the flexible line of defense through prevention. To strengthen the flexible line of defense knowledge is required to have a better understanding of how to maintain a safe environment for children riding in motor

vehicles in order to maintain client stability or wellness. Therefore, the education intervention will focus on increasing parents knowledge about the injury outcomes from inappropriate safety restraint use, to increase parental knowledge with regards to the four transition phases to base choice and selection of the correct CRD, and to increase parent knowledge on the weight and height scale with respect to the appropriate CRD.

The third assumption is, “primary prevention relates to general knowledge that is applied in client assessment and intervention in identification and reduction or mitigation of risk factors associated with environmental stressors to prevent possible reaction” (Neuman, 1995, p. 20). This study’s central focus of primary prevention is the parent’s knowledge of CRD safety that they use and apply on a daily basis to protect their child in a motor vehicle with the goal to prevent injury and even death.

In the Neuman Systems Model, health promotion is subsumed within the area of primary prevention and becomes one of the specific goals within the model for nursing action. According to Neuman, primary prevention is carried out when a stressor is suspected or identified and a “reaction has not yet occurred, but the degree of risk is known” ...and the major goal for nursing is to reduce stressor impact and increase client resistance by strengthening the individual’s flexible line of defense to decrease the possibility of a reaction (Neuman, 1995). MVC’s are the leading cause of death of children and “motor vehicle injuries are one of the most common causes of preventable childhood injuries and fatalities” (Stokes, et al., 2000). Therefore, primary prevention is based on the fact that the degree of risk is known from MVC’s which is injury and even death, therefore nursing will play an active role in the prevention of childhood injury through intervention.

Intervention goals include education and appropriate supportive actions toward achieving optimal client wellness, that is, augmenting existing strengths related to the flexible line of defense and thereby decreasing the possibility of risk of injury and death to the child to riding in motor vehicles (Neuman, 1995). Intervention involves increasing the parents knowledge base with regards to the following: utilizing the appropriate child safety device for children using height and weight as the guide; to better understand the height and weight parameters around transition times from one safety device to the next; and to increase parents awareness regarding injury outcomes.

Primary prevention may be viewed as education in terms of preventative aspects of maintaining a safe environment for children while riding in a motor vehicle. The intervention included the following: that parent/parents set good examples to their children by consistently using the vehicle seat belt; that parent/parents use the appropriate child safety system and maintenance of appropriate use of the child safety system; that parent/parents do not transition the child too early into an adult seat belt; and to have a knowledge of the injury outcomes experienced by children who are involved in MVC's.

In conclusion, primary prevention will assist to reduce the possibility of injury to a child during a MVC through education. Nursing practice goals will enable parents in the maintenance of optimal client system wellness which encompasses vehicle safety for their child or children..."through purposeful interventions" (Neuman, 1995, p. 16).

## Chapter 4

### Methodology

#### *Research Design*

This research study used a pre-test, post-test quasi-experimental design (Polit & Hungler, 1999). A one group pre-test-post-test design is a design that involves one set of measurements taken before and after treatment of one group of subjects. The one group measurements before and after the intervention determines the effect of the treatment (Polit & Hungler). A quasi-experimental design involves the manipulation of an independent variable. In this study, the independent variable was the parents' accurate use of child safety seats to protect children from injury in the event of vehicle collision. The dependent variables were parental knowledge of the following: injury patterns in children due to vehicle collision, appropriate type of seat for the child's height and weight, appropriate fit of the child to the safety seat, and the appropriate location of safety seat in the motor vehicle. This intervention was developed as part of a larger study that examined intervention strategies to support safe use of safety seats for children aged 0 to 12 years old.

The larger study involved a multidisciplinary research team working collaboratively in four different sites in the province of Ontario, supported through the AUTO21 Initiative. The educational intervention was developed by the AUTO21 research team focused on the parent knowledge of vehicle safety for their children. The intervention program was developed based on findings from the research literature, and most directly, findings from the preliminary survey research in the first phase of the larger study.



### *Research Hypotheses*

The following hypotheses were tested in this study:

Hypotheses 1: Parents will demonstrate an increase in knowledge in the correct CRD for the child's weight and height.

Hypotheses 2: Parents will demonstrate an increase in knowledge regarding the correct fit of the child in the CRD.

### *Setting*

This research study was conducted in a small rural city in Southwestern Ontario with a population of 43,000. The county in which the city is located has a population base of 110,000 which includes 5 small towns, and 4 villages (Statistics Canada, 2002). The area is largely comprised of both urban and rural settings with a predominantly farming and industrial base. This particular city was one of the four sites of the larger intervention study.

Data collection took place in the Day Care facilities located in the urban centre of the city. One Day Care is publicly funded, the YMCA (Young Men's Clubs of America) housed three daycare locations in the city providing care for a total of 149 families, the ages of the children ranged from 18 months to 60 months of age.

Two private Day Care Centres were accessed as well. The two private Day Care Centres served a total of 150 families with the ages of the children ranging 18 months to 60 months of age.

The program structure of the Day Care Centres used for this study were very traditional whereby parents bring their child or children to the Day Care Centre and leave them to participate and enjoy the daycare curriculum independently. This traditional

approach allows parents little or no involvement in their child's learning or socialization in the Day Care Centre setting. The Day Care staff plan the children's learning according to identified themes. During the implementation of the study, the theme of vehicle safety was integrated into the day care program with the support of staff members, using the intervention materials developed for the study.

### *Sample*

A convenience sample of 117 families was obtained from the Day Care Centre sites of the study. A sample of 117 families participated in the study, reporting on 154 children, with 97 completed and analyzed data set for the final results of the study.

To participate in the study, parents had to have one or more children between the ages of 18 and 60 months of age enrolled in one of the Day Care Centre programs. Permission to approach parents to participate in the study was requested through the administrator in charge of the Day Care Centre. Selection criteria included: parents were English speaking and able to read at a Grade 6 level, and the parent had a child or children between the ages of 18 and 60 months who attended the Day Care Centres.

Parents were approached to participate in the research study using three strategies: (1) a poster was displayed in each of the Day Care Centres explaining the research study and inviting all parents to participate (Appendix C); (2) an information letter was sent home in each child's backpack explaining the research study and encouraging parents to participate (Appendix D); and (3) the personnel of the Day Care Centres approached each parent to ensure that they were informed of the research study.

### *Parent Demographics*

A sample size of  $n = 97$  parents were surveyed,  $n = 56$  (Chatham) and  $n = 41$  (Lindsay)

(Table1). Once sampling in Chatham reached  $n = 56$ , it was necessary to sample from an additional rural community in order to achieve the desired sample size for the study.

Ethics approval to extend the study to Lindsay, Ontario was granted. Lindsay is a rural town in Ontario located within the City of Kawartha Lakes, with a population of approximately 83,000. Lindsay is similar to Chatham, as it is comprised predominantly of farming communities with an industry and tourism base.

The average age of participants ranged from 31 to 40 years of age. Eighty-six percent of the participants were female and 78.7% of the female participants were the children's mother and 13.8% were the children's father and the remaining 7.5% were grandparents, aunts and guardians. Of the participants 80.9% were married. The majority (47.3%) of the participants resided within a rural setting, with a population range from 1,000 to 30,000. The remaining 35.2% resided in a large town or city setting with a population range of 30,000 to 100,000.

There was a noted difference in the two samples with regard to average income of the parent participants and their education level. In Chatham, the average income of the participants ranged from \$40,000 to \$60,000 and below, and only 19.7% with an income of over \$80,000. In Lindsay, the majority of (58%) participants reported an average income over \$80,000, and 37% of the participants reported an income range of \$60,000 to \$80,000. In Chatham, 70% of participants had a college certificate/diploma or a university degree and the remaining 30% had a high school diploma or some high school education. In Lindsay, 92% of the participants had a college diploma or a university degree and the remaining 8% had a high school diploma or some high school education. The majority of the participants owned and drove minivans (44.2%), a four door sedan

(27.4%), a sport utility vehicle (14.7%), a pick up truck (6.3%) and the remaining 5.4% drove other types of vehicle which included two door coupe, station wagon or other. Of vehicles driven by the participant population, 93% of the vehicles had airbags, and 80% of the vehicles had driver and front passenger air bags only.

### *Children Demographics*

Participants reported on a total  $n=154$  children (Table 2). The range in age of children reported on was from 8 months to 149 months. Of the children in the study, 57.8% ( $n = 89$ ) of the children were male and 42.2% ( $n = 65$ ) of the children were female. The children's heights ranged from 22.5 (57cm) to 60 inches (153cm) and the children's weight ranged from 19 (8.6 kg) to 110 pounds (50 kg). The average child's height was 38.3 inches (98cm) and the average weight was 39.2 pounds (17.8 kg).

Table 1

*Parent Demographics*

The Parents		Chatham		Lindsay	
		N	%	N	%
Age	20-30 years	16	30	5	13
	31-40 years	31	58	26	66
	41-50 years	3	6	6	15
	51-60 years	1	2	1	3
	60-70 years	2	4	1	3
Sex	male	7	13	6	15
	Female	47	87	33	85
Marital Status					
	Single	9	16	1	3
	married/common law	40	73	36	92
	separated/divorced	6	11	2	5
Relationship of Child					
	Mother	44	80	30	77
	Father	7	13	6	15
	Guardian	0	0	2	5
	Grandparent	4	7	0	0
	Other	0	0	1	3
Population size of city					
	100,000-300,000	4	8		
	30,000-100,000	20	38	12	31
	1,000-30,000	25	48	18	46
	<1,000	3	6	9	23
Income					
	<\$20,000	3	6		
	\$20,000-40,000	11	22		
	\$40,000-60,000	13	26	2	5
	\$60,000-80,000	12	24	14	37
	>\$80,000	11	22	22	58

*Note:* Total Cases = 97; N = number; % = percentage based on total cases reported on

rounded to the nearest whole digit.

Table 2

*Children Demographics*

<i>The Children</i>	N	%
Age		
Infant 0 to 12 months	2	1
Toddler 13 to 48 months	86	56
School Age $\geq$ 49 months	66	43
Sex		
Male	89	58
Female	65	42

*Note:* Total Cases = 154; N = number; % = percentage based on total cases reported on rounded to the nearest whole digit.

*Intervention Program*

The intervention program was developed based on earlier survey investigations of the larger AUTO21 study. In the larger survey study, 2199 children were described by their parents in terms of how parents were using safety systems and parents knowledge of safety system use. Based on the findings of the early survey research, four patterns of misuse were clearly evident: (1) incorrect car seat used for the height and weight of the child; (2) poor fit of the child in the car seat; (3) child seated in the inappropriate location of the motor vehicle; and (4) widespread premature transition to new safety seat systems.

In this study, the safety concepts parents learned throughout the intervention included: risk of injury outcomes for children due to motor vehicle collision, correct safety seats for children according to height and weight parameters, correct location of safety seats in vehicles, and appropriate transitions times from one car safety seat systems to another.

The intervention program was developed around three key concepts: (1) correct use; (2) appropriate transitioning times; and (3) pertinent information regarding injury outcomes. These three key concepts provided the framework for the intervention program as well these concepts were incorporated into the learning strategies and materials used for the parent education intervention.

### *Preliminary Focus Groups*

Education materials should be meaningful to enhance parents learning, therefore two pre-intervention focus groups were conducted. The purpose of the focus groups was to generate from parents strategies or learning venues perceived to be most meaningful for parents. Focus groups were used to seek parent input in validating learning strategies in order to select appropriate teaching strategies for the parent education package. Two focus groups sessions comprised of parents with young children, grandparents, expectant parents, and health care providers were conducted. Each group consisted of ten to fifteen individuals assembled together for a group discussion on the topic of child seat safety in motor vehicles (Polit & Hungler, 1999). Individuals were invited to participate in the focus group discussion by way of an information flyer displayed on hospital bulletin boards, at drug stores and at churches.

The focus groups were one hour in length. A written set of questions was established to guide the discussion (Polit & Hungler, 1999). For the focus groups, the following questions were used to guide the discussion: (a) what motivates you to learn? (b) tell us how do you like to learn?; and (c) how do you remember important things? Information gathered from the focus group discussions was used in the development of education materials for the parent education package. Some common trends which

emerged from the focus group discussions included: “use shock but not real life situations”, “give simple straight facts and statistics that are easily remembered”, “use materials that a parent can interact with their child or children”, “visual reminders”, make me feel guilty “parent guilt” will make me want to know more, and repetition is helpful.

The intervention design incorporated the focus group findings. Education materials used to facilitate and support learning included: (a) a storybook titled, “Bobby Shooster Rides Safely in his Booster” for the parent to read with their child so they learn about car seat safety together, the main plot of the story is finding the correct car seat; (b) a parent learning guide was incorporated into the storybook “Bobby Shooster Rides Safely in his Booster”. The parent learning guides was designed to increase parental knowledge of the safety concepts being taught throughout the storybook; (c) a CD Rom presentation included factual information as well as video clips; a slide presentation titled, “What Parents Need to Know About Car Seats”, stressed the importance of using appropriate car seat systems, and illustrated the correct seat use for height and weight of the child and performs installation of each type of CRD incorporating key correct fit points for the parent; (d) a “Car Seat Safety Chart” a height - weight chart explained the concept of transition times to move a child from one CRD to the next CRD; (e) a fact sheet which gave hard facts of pertinent information regarding injury outcomes; and (f) a “Do’s and Don’ts” list which incorporated the most important do and don’ts’ regarding child vehicle safety and correct car seat use.

### *Description of Materials of the Intervention Program*

#### *Storybook and Parent Guide*

The storybook entitled, “Bobby Shooster Rides Safely in his Booster” was developed



for the larger study. The purpose of readings the storybook was to teach the children about the important concepts of vehicle safety when riding in a motor vehicle. The parent's version of the storybook included a parent explanation pages to guide the parent on the key points of car seat safety described in the story. This supported the adult learning principle of motivation. Motivation is enhanced by the way in which material is organized...“best organized material makes the information meaningful to the individual“ (Redman, 1993, p. 34). A parent knows about the need to keep their child or children safe, therefore the parent guide will assist the parent to easily connect the concept of vehicle safety with the important factors being communicated in the story. Motivation is also supported by the feedback remarks of the focus groups which indicated using materials that create the possibility of interaction between the child or children and parent was very important to learning.

#### *CD Rom*

A CD Rom was provided in the parent education package as an executable file so that parents simply clicked on the file icon and the presentation began automatically. The CD contained a six minute clip of a simulated motor vehicle crash using a anthropomorphic computer generated child to see what happens during a minor collision. This video clip showed both rear and forward facing crash scenarios. As the child rides down the crash, the force a child sustains in a crash was clearly illustrated in the animation. The CD also included video clips with permission from Childrens Hospital of Philadelphia (CHOP) that instructed parents on correct use of safety seats. A powerpoint presentation on the CD included key points such as; motor vehicle crashes are the leading cause of death of children in North America; 82% of child safety seats are not properly used; if not used

properly paralysis, irreversible brain damage, and even death can occur. One of the most common trends indicated from the focus groups was the need to use shock. Several of the participants within the focus groups stated that, “shock is a good way to get a parent’s attention.” By demonstrating the crash impact and injuries outcomes for children, the principle of stimulation and affect are relevant. Stimulation and affect were strategies used to highlight important factors when an individual experiences a reaction when learning something, therefore shock will have parents sit up and take notice (Redman, 1993).

### *The Car Seat Safety Chart*

The “Car Seat Safety Chart” is the same chart that the child and parent read about in the storybook. The “Car Seat Safety Chart” is a tool that the parents can use and re-use with their children. The chart is a specialized growth chart that illustrated the concept of transition times.

### *Fridge Magnet*

The fridge magnet displayed the same information as the “Car Seat Safety Chart”, however the fridge magnet transition time information is displayed in a quick point form structure. The fridge magnet serves as a quick reminder for the parent. Parents were encouraged to place the magnet on their refrigerator. Accurate transitioning of children is key for parents to understand and make an informed decision in the selection of the appropriate car seat.

Both the “Car Seat Safety Chart” and the fridge magnet support the adult learning principle of repetition and reinforcement (Redman, 1993). This teaching modality is supported by the focus group feedback when the participants referred to the use of visual

reminders, keeping it simple and repetition being helpful.

*Fact Sheet and the “Do’s and Don’ts” List*

The fact sheet as well as the Do’s and Don’ts” List displayed the most important information parents needed to remember about child vehicle safety. Both the sheet and the list were short and to the point. The fact sheet and the list were used to remind parents of risks and the most important points of child car seat use. Reinforcement is the learning concept that formed the basis of these educational tools. Reinforcement is valued by the participants if it is attached to key concepts being learned (Redman, 1993). Both of these education tools were identified by the focus group comments of “give me simple straight facts and tell me what are the most important things to remember”.

The goal of the intervention was to increase parents’ knowledge of child vehicle safety involving an increased knowledge of injury outcomes of MVC’s, the correct use of the CRD, and the appropriate timing for transitioning a child from CRD to the next CRD. Therefore, this intervention provided parents with multiple tools to use in their decision-making to ensure children are positioned appropriately in the correct CRD, the correct fit of the child in the CRD, and the correct location of the CRD in the motor vehicle.

*Instrumentation and Materials*

The two instruments used in the pre-test and post-test were: a questionnaire and a multiple choice quiz. The questionnaire used in the pre-test and post-test was developed as part of the larger AUTO21 study. The questionnaire was titled, “Infant and Child Car Seats: A Survey of Parent’s Knowledge and Use” which contained 5 sections (Appendix E). The instrument went through extensive validation, questions were clarified and re-designed to add clarity and conciseness to capture the variables and information being

examined in the research.

The multiple choice quiz was developed to review what parents know about correct fit with regard to car seat use pre and post test (Appendix F). The quiz developed for this study used the American Academy of Pediatrics (AAP) website 'parent quiz' format and included questions appropriate to this study ([www.aap.ca](http://www.aap.ca)). The AAP is regarded in health care as one of the leading sources of evidence based information on child safety and injury prevention (Howard, 2004).

For the purpose of the quiz correct fit was defined as: doing up clips, buckles, belts and knowing that straps and belts need to be flat not twisted, knowing that the straps should allow one finger between the strap and child's body, the car seat should move when secured to the vehicle no more than one inch, as well as appropriate location of buckles and straps on the child's frame.

The quiz challenged parents to test their present knowledge of child car seat safety and more specifically the correct fit of the child to the car seat. This reflects the adult learning principle of motivation, as described by Redman (1995). Parents indicated in the focus groups that "making a parent feel guilty", will only make the parent want to know more. Therefore, if the parent does not know the answer or had an incorrect answer the parent will feel guilty and be motivated learn what he or she does not know by reviewing the material provided in the parent education package.

### *Procedure*

The same procedure was used at all the Day Care Centres regardless of the time of day (day or evening). The only difference was that during the evening sessions, pizza and juice for parents and children was provided as the sessions were scheduled during dinner

time hours. At each session, a display table was set up with the following: a laptop computer with the CD playing; the "Car Seat Safety Chart" was placed on the wall nearby; and all the components of the intervention education package were displayed. During day and evening hours in the Day Care Centres, the researcher was on site at all times. The Daycare staff read the storybook to the children and the children were given a colouring book, crayons, and safety badge.

Parents were informed about the research study in two ways: (1) a poster display (Appendix C), and (2) an information letter that was sent home in each child's backpack (Appendix D). The poster display was exhibited in each of the Day Care Centres and each of the Day Care Centres engaged in the activity of sending a package home in each child's backpack announcing about the upcoming event.

Consent was obtained in the following ways. During the day sessions, parents' who were interested in participating were given a consent to read and an opportunity to ask the researcher questions. If the parent wished to participate a consent was signed and a copy of the consent was given to the parent to keep. Some parents chose to take the consent home to read and interested parents returned the consent signed the next day to the researcher. Once consent was received, the parent was given the pre test instruments (questionnaire and quiz). Some parents chose to complete the pre test instruments at the Daycare and others took the pre test instruments home and returned the pre test instruments completed the next day. When the pre test instruments were completed and returned to the researcher, the parent was given an intervention education package. At this time, the researcher briefly reviewed with the parent the contents of the education package and had the parent watch the CD powerpoint presentation.

During the evening sessions, parents who were interested in participating reviewed the consent, consent was obtained on site and a copy of the consents was given to the parent. Immediately following consent, the parent filled out the pre test instruments. When the pre test instruments were completed and returned to the researcher, the parent was given an intervention education package. At this time, the researcher briefly reviewed with the parent the contents of the education package and the parent watched the CD powerpoint presentation.

A research log was maintained by the researcher and at the 6 to 8 week post-test interval the researcher conducted telephone follow-up calls. The researcher administered to the post test instrument (questionnaire and quiz) during the telephone follow-up calls. As the participants answered the questions the researcher recorded the answers onto the post test instruments.

### *Data Analysis*

The demographic data of parents and children was categorical, ordinal and interval in nature and the findings from the frequency analysis are presented descriptively in Tables 1 and 2 (Polit & Hungler, 1999).

Correct seat, (Hypothesis 1) was tested using a sign test to determine whether the mean value of the educational intervention variable in the pre-test differed significantly from that of the post-test within the same group. A sign test "is a non-parametric test that can be used to compare two paired samples" (Fergusson & Takane, 1989; Samuels & Witmer, 1999). The sign test was used because the data is categorical and the groups are dependent (Samuels & Witmer). The information used in the sign test is the "sign of positive or negative. If the differences are preponderantly of one sign, that is taken as

evidence against the null hypothesis (Samuels & Witmer). The data specifically tested using the sign test was the section entitled "Use of Infant and Child Car Seats Questionnaire" (Appendix E). In addition, an analysis of the magnitude of the change in parent knowledge scores from pre-test to post-test was examined using a simple change analysis. The percentage of correct and incorrect answers was recorded. At the pre-test answers were compared to the post-test answers and then plotted graphically for each type of knowledge question in the instrument. A graphical representation of the change analysis is captured in figure 10.

The impact of the intervention program on parents' confidence level from pre to post test was measured using a paired t-test. The paired t-test was used for this as the data is interval and the sample is related due to the pre-post test design (Burns & Grove, 1997). Parents were asked to rate their confidence with their knowledge of correct seats for the age, height, and weight of the child.

Correct fit, Hypothesis 2 was tested using a quiz, which reflected parent knowledge of correct fit. This data was analyzed using a paired t-test. The data is interval data and the sample is related due to the pre-post test design (Burns & Grove, 1997). The data derived for this analysis was taken from the Car Seat Quiz (Appendix F), correct answers were coded as 1 and incorrect answers were coded as 2.

### *Validity and Reliability*

Content validity addresses the appropriateness of the instrument items as they relate to the particular constructs under investigation (Polit & Hungler, 1999). The questionnaire utilized for this particular research study had been previously used in a much larger research study in which the construct of vehicle restraint use was thoroughly examined

and supported. Content validity was supported in a series of pilot studies of the survey instrument. Initially, the instrument was administered to 120 undergraduate nursing students who were asked to identify questions they felt were difficult to answer or understand. On the basis of that pilot test, changes to the survey were made and it was administered a second time to a different class of 100 undergraduate nursing students. On the basis of the second pilot study with students, the survey was piloted a third time and was administered to a group of 25 parents of children under 9 years of age in the community. The instrument was revised and distributed to an expert panel for evaluation. The expert panel consisted of reviewers who were very familiar with the issues of motor vehicle occupant safety and injury outcomes related to MVC's. The written feedback from the expert panel indicated that the instrument content reflected the intended construct.

History refers to the occurrence of external events that take place concurrently with the independent variable that can affect the dependent variables of interest (Polit & Hungler, 1999). At the time of the study, there was a "Fit-for-a-Kid" National campaign launched by Daimler Chrysler Canada regarding child seat safety. As well there were car seat clinics running on a regular basis in both the Chatham and Lindsay areas.

Selection effect could also be a threat to internal validity. In this particular research the participants selected themselves to participate or not to participate in the study, therefore through self-selection the researcher was aware of social desirability. Participants in the study may record the answers on the pre-test and post-test questionnaire thinking about what the researcher wants to see as the answer rather than what the participants actual vehicle safety practices are. The questions on the pre and



post-test instrument used hypothetical situations in order to minimize social desirability in their answers. For example, parents were asked “at what age, height, and weight should you tell a friend it is safe to move their child to a “forward facing seat...” Since parents didn’t have to report on their own behavior relative to their child’s use of safety systems, they might be less likely to be too concerned about what answer they put down as would not be reflective of their practice. When the intervention education packages were given to the parent participants, the researcher encouraged them to put down true answers, and that the researcher would not be correcting the questionnaire and quizzes individually.

Another threat to internal validity is maturation. Maturation refers to the processes occurring within the subjects during the course of the research study, which is the result of the passage of time rather than a result of treatment or independent variable (Polit & Hungler, 1999). In this research study, the time period (6 to 8 week period) for data collection from pre-test to post-test minimized the effect of maturation. The child’s physical growth from one car safety seat system to the next was unlikely to occur during this short time period, and the potential for parents to learn from external sources about car safety for children was less likely given the short time frame.

Testing effects may have occurred in this research study. Testing effects refer to the effects of taking the pre-test on the participants’ performance on a post-test (Polit & Hungler, 1999). The questionnaire itself might have a change in parental attitudes toward car seat safety or even increase the parent’s knowledge base regarding car seat safety without ever having undergone the intervention. By virtue of the parent knowing that they are participating in a safety research study may have influenced the way they

think about their child's safety when riding in motor vehicles.

### *Ethical Considerations*

Approval for the research was obtained from the Research Ethics Board of the University of Windsor. An information letter inviting parents to participate included an explanation of the research study (Appendix D). Participation in the study was strictly voluntary and participants were free to withdraw from the study at any time without consequence. Confidentiality was assured to all participants, no identifying information was on any study data. The study data was kept confidential and information was accessible by the researcher of this study and the multidisciplinary research team of the larger study. All information collected for this research study was kept in a locked drawer accessible only by the researcher and the multidisciplinary research team.

## Chapter 5

### *Results*

The purpose of this research was to investigate the effectiveness of a parent focused intervention for children 0 months of age to 10 years of age. The first set of results focused on parents' actual use of safety seats for their children. The second set of results examined the effectiveness of the intervention program on parents' knowledge of correct use of safety seats and how knowledge influenced their decisions on transitioning their child from one safety system to another.

### *Parents' Actual Use of Safety Systems*

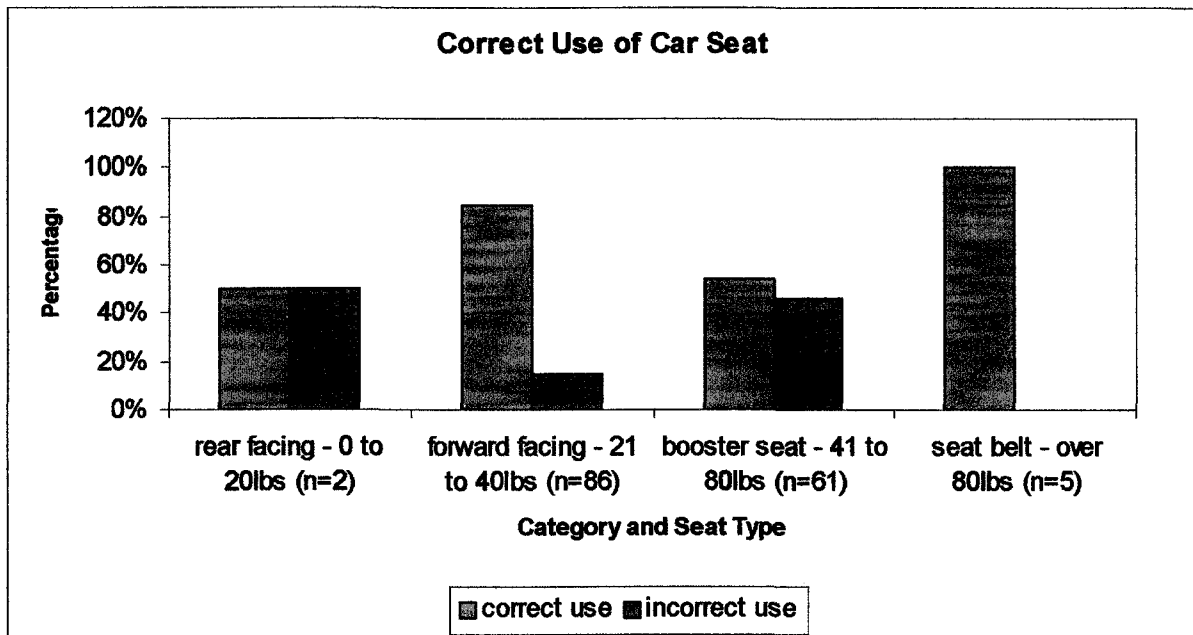
Parents were asked what type of CRD their children were presently using at the time of the pre-survey (Figure 5). The concept of correct use of safety systems in this study was defined as correct seat for the height and weight of the child (i.e., rear-facing seat =  $\leq$  12 months and  $\leq$  20 lbs.; Forward facing = 21 – 40 lbs and 27 to 40 inches; Booster seat = 41 – 80 lbs and 41 to 56 inches, and seat belt =  $\geq$  80 lbs and 57 " tall).

There were only two infants reported on in this study, one was seated correctly and the other was seated incorrectly in a forward facing car seat. In the toddler group ( $n=86$ , 13-48 months) using forward facing seats, children with a weight of 21 to 40 lbs (10 to 18 kg) 73 children (84.8%) were correctly seated, and 13 (15.1%) were incorrectly seated either in a booster seat or seat belt system. For school aged children ( $n = 61$ ) 33 children (54.1%) were seated correctly in a booster seat, and 28 children (45.9%) were seated incorrectly in a seat belt. Only a small number of children were  $\geq$  80 lbs in this study ( $n=5$ ), 100% were seated correctly.

Figure 5 indicates the rate of correct seat use according to age and weight for the

entire study. Overall 73%(n = 112) of the children in the study were reported by their parents to be seated in the correct seat and 27% (n = 42) of the children in the study were reported by their parents to be seated incorrectly.

Figure 5



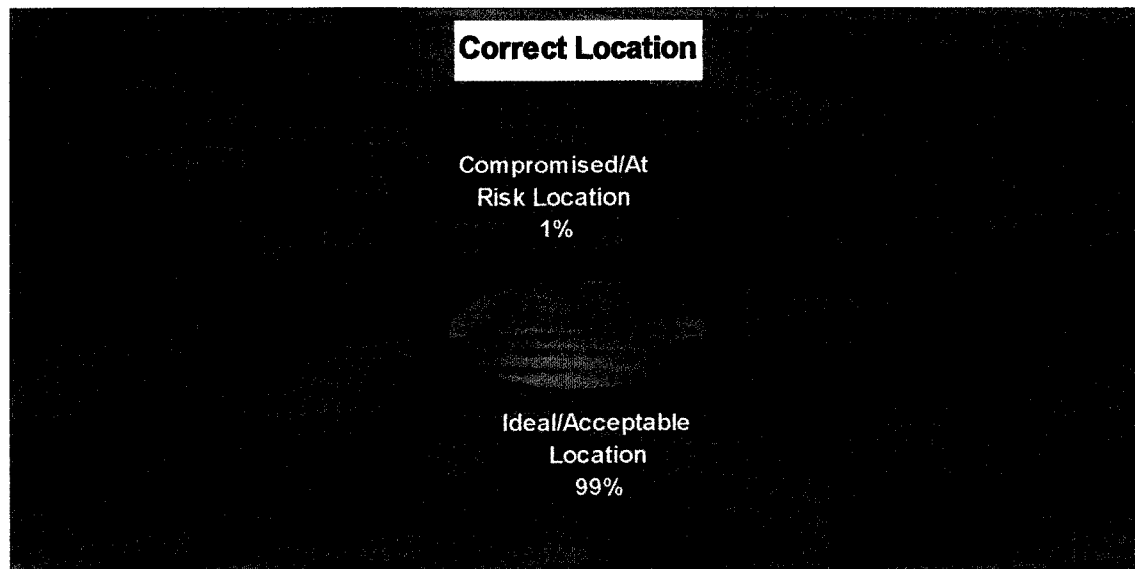
#### *Location of Child in the Vehicle*

The survey asked parents to describe where their child or children usually sit in the vehicle when being transported. Positioning in the vehicle was defined by ideal and acceptable, compromised and at risk. Ideal by definition means that the child would be placed in the most ideal location of the vehicle being the middle of the back seat. Acceptable was defined as the outboard back seat of the vehicle either behind the driver's seat and/or behind the front passenger seat. Compromised and at risk by definition means that the child was placed in the front seat of the vehicle with no air bag or seated in the front seat with an active air bag placing the child at a higher risk for injury. When location of the child in the vehicle interior was examined, the majority of children 98.6%

(n=140) were seated in the ideal or acceptable location of the vehicle, whereas 1.4% (n=2) were placed in a compromised location (Figure 6).

Figure 6

*Correct Location of Children in Vehicles*



Parents in this study reported that their child/children never sit in the front seat of the vehicle (83%, n = 120). However, when parents were asked if their children ever sit in the front seat, 17% (n = 24) of the children were reported to sit in the front seat for the following reasons: the vehicle only has one row of seats (n=4); the child will not sit anywhere else (n=1); when the children is transported by others (n=2); parents allowed their children to seat in the front seat as a reward (n=7); and some parents indicated that they like to have their children sit next to them in the vehicle (n=3). Other reasons such as “just going to the grocery store”, “just going around the block”, “going on a short trip in the neighborhood” (n=7) were reported.

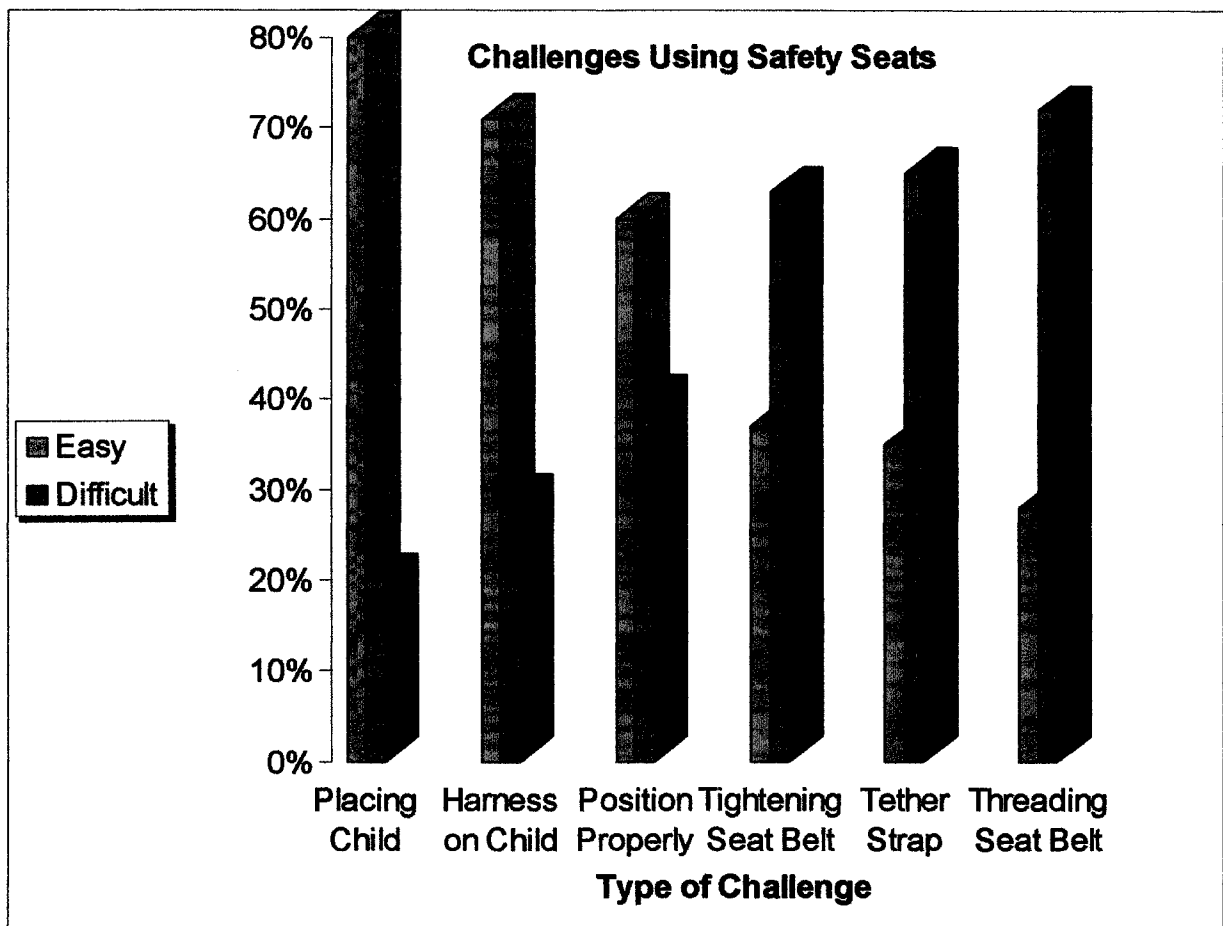
*Challenges Parents Experienced Using Safety Seats*

Parents were asked to describe the ease or challenge of installing car seats in their

vehicle using a 6-point scale (Refer to Section 2, Question 5 of the Infant and Child Car Seats: A Survey of Parents' Knowledge and Use, Appendix E). Parents reported the three most difficult challenges of installing car safety seats as: (1) threading the seat belt through the slot in the rear of the CRD (77%), (2) tightening of the tether strap (65%) and (3) tightening of the seat belt (62%) when correctly fitting the seat to the vehicle with the child in the CRD (Figure 7).

Figure 7

*Challenges Parents Reported Using Safety Seats*



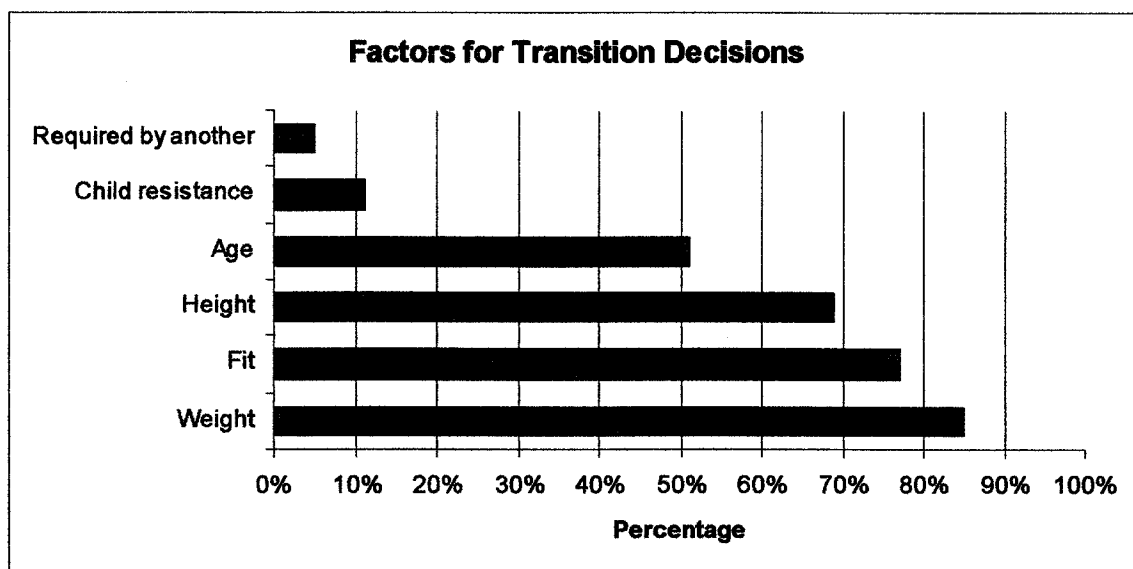
*Parents Decisions to Transitioning Child to New Safety System*

Parents were asked to identify the factors that they considered when making the

decision to transition their child into a new car safety seat (Figure 8). The majority of parents, 85% (n = 127) identified the child's weight as an important factor in the child's transition to another car seat. The second most important factor was that the child no longer appeared to fit in the car seat (77%, n = 115). The third important factor parent identified was the child's height (69%, n = 104) and the least important factor was the car seat required by another child (5%, n = 8).

Figure 8

*Factors for Transition Decisions of Parents*



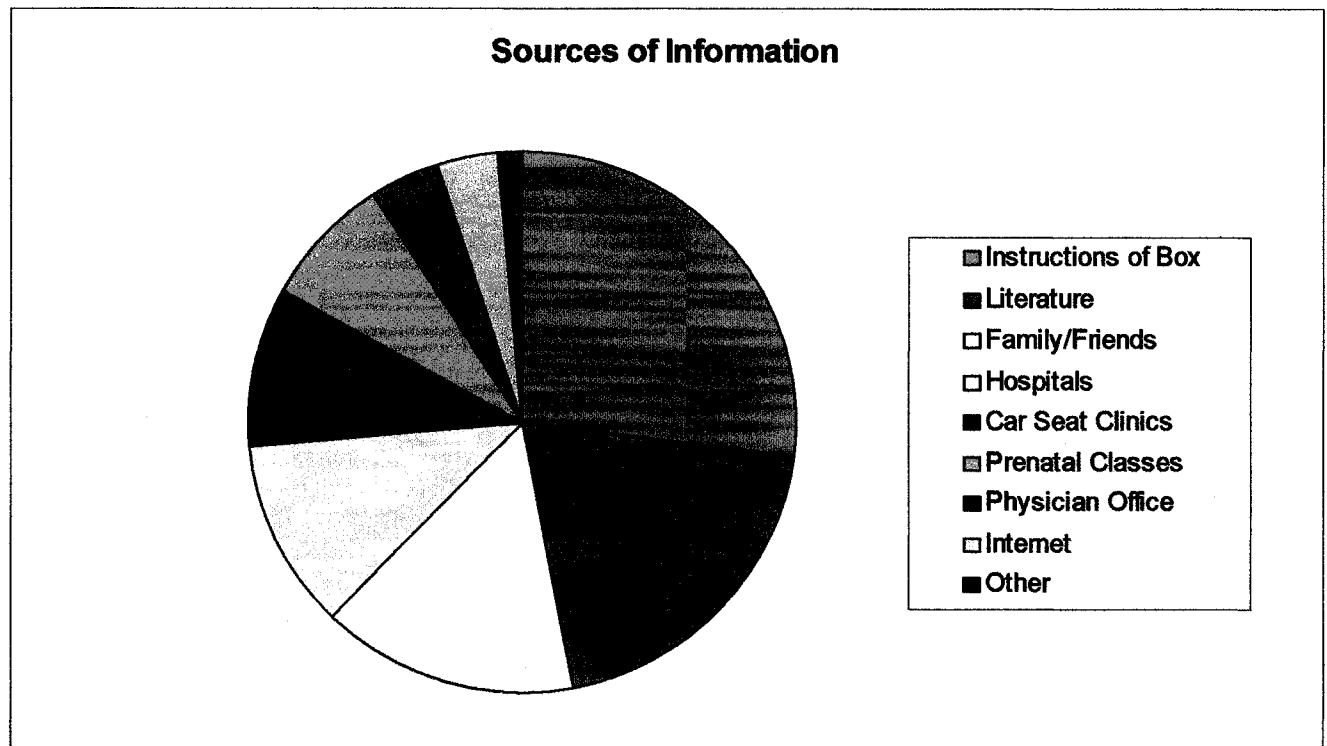
*Sources of Information*

The majority of the parents indicated that they received information regarding the safe use of car seats by reviewing the instructions on the box the car seat was packaged in. The second source of information was pamphlets and magazines, family and friends. The third indication was attending a car seat clinic, getting information from the hospital, and prenatal classes. The least most common source of obtaining information was using the Internet and seeking information from the family doctor, pediatrician or public health

nurses (Figure 9). The majority of the parents, 66.3% (N=59) reported that was easy to find information about the safe use of car seats and 33.7% (N=30) reported that it was difficult to find information about the safe use of car seats.

**Figure 9**

*Sources of Information*



*Effectiveness of Intervention on Parent Knowledge*

Parent knowledge was examined pre-intervention and post-intervention, six to eight weeks after the intervention. At the pre-test parents described their knowledge of correct seat according to age (for infants only), height and weight, the factors most important in deciding when to move their child to the next type of safety system, and their confidence with their knowledge of correct seat. The questions on the pre and post-test instrument used hypothetical situations in order to minimize social desirability in their answers. For example, parents were asked “at what age, height, and weight should you tell a friend it is



safe to move their child to a “forward facing seat...” The incidence of missing data was very minimal for the post-test questionnaire since telephone follow-up interviews were used to ensure the questionnaire was fully completed.

The first hypothesis examined was, parents will demonstrate an increase in knowledge in the correct CRD for the child’s weight and height using sign test. Since the p-value ( $p = .001$ ) was smaller than  $\alpha .05$ , the null hypotheses was rejected, findings indicated that parents experienced an increase in knowledge in the correct CRD for the child’s weight and height (Table 4 and Table 5).

Similarly, the change analysis of parent knowledge (correct vs. incorrect) indicated a significant increase in parent knowledge of the age, height and weight a child can be safely transitioned from a rear facing to forward facing seat, forward facing to booster seat, and booster seat to seat belt (Table 3 and Figure 10). In the rear facing to forward

Table3

*Difference from Pre to Post Intervention*

		Pre-test		Post-test				Percentage			
		C	I	C	I	n	n	Pre	Post	delta	%delta
Age	RF to FF	39	26	59	6	65	65	60%	91%	31%	51%
Height	RF to FF	22	51	52	21	73	73	30%	71%	41%	136%
	FF to BS	24	42	56	10	66	66	36%	85%	48%	133%
	BS to SB	28	36	62	2	64	64	44%	97%	53%	121%
	BS to SB	28	36	62	2	64	64	44%	97%	53%	121%
Weight	RF to FF	77	18	88	7	95	95	81%	93%	12%	14%
	FF to BS	65	29	88	6	94	94	69%	94%	24%	35%
	BS to SB	47	48	87	8	95	95	49%	92%	42%	85%

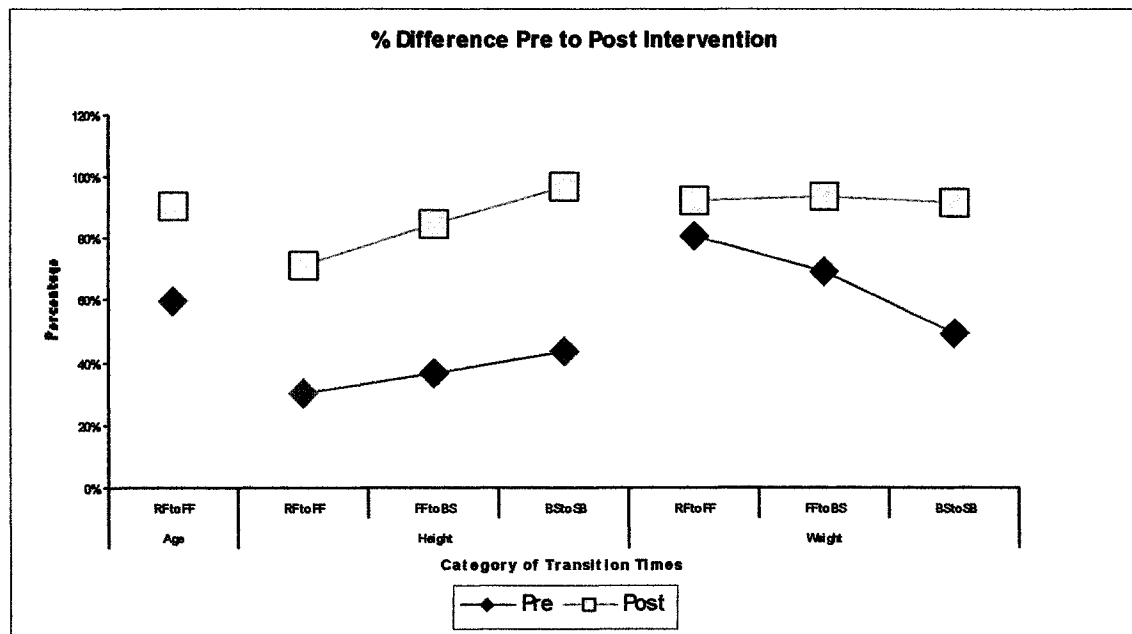
RF-rear facing  
FF-forward facing  
BS-booster seat  
SB-seat belt

facing seat transition time there was a dramatic increase of 30% from incorrect to correct answer in the age category. Parental knowledge within of safest height to transition a

child from either forward facing to booster seat and booster seat to seat belt was clearly evident following the intervention program. Parents also learned the safest weight to transition a child from a forward facing to booster seat and booster seat to seat belt which suggests a considerable increase in parental knowledge following the intervention program. There was only a slight increase in knowledge following the intervention program of the weight an infant should be to transitioned to a forward facing seat from a rear facing seat.

Figure 10

*Difference Pre to Post Intervention*



At the pretest, the majority of parents 78.3% (n=71) could correctly identify the placement of a seatbelt on the illustrations in the survey. At the post intervention there was a significant change in parents' knowledge on all of the variables associated with correct use of safety seats with the exception of the weight the infants can be safely transitioned from a rear facing seat to a forward facing seat (Table 3 and Table 4).

### *Parent Confidence*

There were statistically significant higher levels of confidence among parents relative to their knowledge of correct use of safety seats based on age, height and weight at the post-test measure, 6 to 8 weeks after the intervention (Table 5). The most significant change in parents confidence level was revealed relative to the transition from booster to seat belt, (n=93) from pre-test  $M \pm SD$   $6.12 \pm 1.88$  to post-test  $M \pm SD$   $8.31 \pm 1.33$ , with a  $t = -9.237$  and a p-value of .001. The second most significant change in parents confidence level was revealed in the transition from forward-facing to booster seat, (n=96) from pre-test  $M \pm SD$   $6.35 \pm 1.85$  to post-test  $M \pm SD$   $8.21 \pm 1.42$ , with a  $t = -8.641$  and a p-value of .001. The least significant change in parents confidence level was noted in the transition of rear-facing to forward-facing car seat, (n=96) from pre-test  $M \pm SD$   $7.02 \pm 2.09$  to post-test  $M \pm SD$   $8.27 \pm 1.58$ , with a  $t = -4.940$  and a p-value of .001.

### *Ranking of Important Transition Factors*

Correct use of children's safety seats requires parents to make a series of decisions about when to transition their child from one safety system to another. In order for parents' decisions to be accurate, they must know the correct age, height and weight of the child and when it is safe to use each type of seat. In this section of the instrument, parents ranked the importance of age, height and weight relative to each safety seat transition (rear facing to forward facing; forward facing to booster; booster seat to seat belt). The intervention program had a positive and significant effect on parents' ability to identify the correct variables associated with safe transitions (Table 7). There were significant changes noted in the height and weight variable for each safety seat transition. The most significant changes were noted in the weight category for the forward facing to

booster seat and booster seat to seat belt transition time. Similarly, there were changes noted in the height variable for all the safety seat transition times.

### *Correct Fit*

The second hypothesis, parents will demonstrate an increase in knowledge regarding the correct fit of the child in the CRD was examined using paired t-test. The mean difference between the pre and post-test scores was -.44086, which was statistically significant  $t(.05, 92) = -4.8842$ ,  $p = .001$  (Table 7). During the collection phase of the post-test and based on feedback from parent participants at the pre-test, 2 of the questions were removed from the analysis. Parents were unsure of what the questions meant and felt that the questions were confusing. Also during the analysis, 3 more questions were removed from the quiz in both the pre and post-test phases as the questions were directed more around correct seat versus correct fit.

Table 4

### *Category Definitions and knowledge rating criteria*

Category	Variable	Knowledge rating criteria		
		Ideal	Acceptable	Wrong
Rear-facing to forward-facing seat	Age	12 months	13 or 14 months	$\leq 11$ or $\geq 15$ months
	Height	26 inches	25 or 27 inches	$\leq 24$ or $\geq 28$ inches
	Weight	20-22 pounds	19 or 23 pounds	$\leq 18$ or $\geq 24$ pounds
Forward-facing to booster seat	Height	40 inches	38-39 or 41-42 inches	$\leq 37$ or $\geq 43$ inches
	Weight	40 pounds	38-39 or 41-42 pounds	$\leq 37$ or $\geq 43$ pounds
Booster seat to Seatbelt	Height	57 inches	54-56 or 58-60 inches	$\leq 53$ or $\geq 61$
	Weight	80 pounds	76-79 or 81-84 pounds	$\leq 75$ or $\geq 85$ pounds

Table 5

*The Impact of the Intervention on Knowledge change from pre-test to post-test*

Transition	Variable	N	Ratings stratified by time of test			Overall knowledge change			Z	P
			Ideal	Acceptable	Wrong	Knowledge increase	Knowledge decrease	Tie		
Rear-facing to forward-facing seat	Age									
	Pre-test	65	36	3	26	26	3	36	-4.085	.001
	Post-test		59	0	6					
	Height									
	Pre-test	73	11	11	51	42	9	22	-4.481	.001
	Post-test		40	12	21					
	Weight									
	Pre-test	95	77	0	18	16	8	71	NC	NC
	Post-test		85	3	7					
Forward-facing to booster seat	Height									
	Pre-test	66	15	9	42	43	4	19	-5.543	.001
	Post-test		50	6	10					
	Weight									
	Pre-test	94	63	2	29	29	6	59	-3.719	.001
	Post-test		84	4	6					
Booster seat to seatbelt	Height									
	Pre-test	64	8	20	36	47	2	15	-6.286	.001
	Post-test		40	22	2					
	Weight									
	Pre-test	95	47	0	48	48	8	39	-5.212	.001
	Post-test		86	1	8					

Z=Sign test statistics

N=Sample Size

NC=NoChange

Table 6

*The Impact of the Intervention on Confidence Level change from pre-test to post-test*

Transition	N	M $\pm$ SD	t	P
<b>Rear-facing to forward-facing seat</b>				
Pre-test	96	7.02 $\pm$ 2.09	-4.940	.001
Post-test		8.27 $\pm$ 1.58		
<b>Forward-facing to booster seat</b>				
Pre-test	96	6.35 $\pm$ 1.85	-8.641	.001
Post-test		8.21 $\pm$ 1.42		
<b>Booster seat to seatbelt</b>				
Pre-test	93	6.12 $\pm$ 1.88	-9.237	.001
Post-test		8.31 $\pm$ 1.33		

t=t-test

N=Sample size

Table 7

*The Impact of the Intervention on Ranking of Important Transition Factors change from pre-test to post-test*

Transition	Variable	N	Rankings stratified by time of test			Overall rating change			Z	P
			Most important factor (1)	Second important factor (2)	Least important factor (3)	Increase in rank	Decrease in rank	Tie		
Rear-facing to forward-facing seat	*Age									
	Pre-test	95	19	2	74	10	12	73	NC	0.832
	Post-test		16	3	76					
	*Height									
	Pre-test	95	30	55	10	15	28	52	- 1.830	0.067
	Post-test		20	62	13					
	*Weight									
	Pre-test	95	45	38	12	30	14	51	- 2.261	0.024
	Post-test		59	30	6					
Forward-facing to booster seat	Age									
	Pre-test	95	13	6	76	0	19	76	NC	NC
	Post-test		0	0	95					
	*Height									
	Pre-test	95	37	46	12	18	23	54	- 0.625	0.532
	Post-test		22	73	0					
	*Weight									
	Pre-test	95	45	43	7	35	6	54	- 4.373	0.001
	Post-test		73	22	0					
Booster seat to seatbelt	Age									
	Pre-test	92	15	4	73	1	17	74	NC	NC
	Post-test		1	2	89					
	*Height									
	Pre-test	93	39	46	8	12	25	56	- 1.973	0.049
	Post-test		21	70	2					
	*Weight									
	Pre-test	93	38	44	11	38	5	50	- 4.880	0.001
	Post-test		71	21	1					

Z=Sign Test

N=Sample Size

NC=NoChange

\*The most important factor for the category

Table 8

*The Impact of the Intervention on Correct Fit from pre-test to post-test*

Quiz	Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the difference		t	df	p
Pre – score Post- score	-.44086	.87802	.09105	Lower	Upper	-4.8842	92	.001
				-.62169	-.26003			

t=t-value

df= degrees of freedom

p=p-value



## Chapter 6

*Discussion*

This study demonstrated a significant increase in parental knowledge of correct car seat use based on the variables of age, height and weight of the child for each type of car safety seat. The impact of the intervention on parental knowledge from pre-test to post-test regarding transition times of children between car safety seats (rear facing to forward facing seats, forward facing to booster seats, and booster seats to seat belts) was clearly evident. The most impressive outcome of the intervention program on parents' knowledge was their knowledge of the importance of weight and height when transitioning children from forward facing to booster seats and booster seats to seat belts. Since the majority of the parents in this study had children of toddler and school ages, this finding is particularly relevant and suggests that parents were very motivated to learn how to keep their children safe in vehicles.

These findings are consistent with Neumans' systems theory, which postulates that a holistic systems approach is used to protect and promote client stability and, to do this one must strengthen the flexible line of defense (Neuman, 1995). Clearly, Canadian parents have the desire and responsibility to keep their children safe while traveling in vehicles in order to protect their child from injury. Over 90% of Canadian parents attempt to use safety systems for their children (Transport Canada, 1996). In order to accomplish this protective goal, parents must strive to provide a stable and safe environment for their children, particularly in vehicles. One of the goals of the intervention was to increase parents' knowledge about the use of the correct car seat based on the child's height and weight parameters. The flexible line of defense

represents the parents' knowledge and understanding of how to maintain a safe environment for their children by using height and weight parameters to select the correct car seat. Neuman's systems model in this study supports primary prevention as an important intervention strategy for injury prevention and health promotion in children. This study was limited to focusing on parents' knowledge as a protective line of defense for keeping their children safe in vehicles. Future research might extend this approach to examine the use of Neuman's model to focus on strengthening a child's flexible line of defense. School age children may influence their parents' decisions regarding safety system use in vehicles. Future research that tests the effectiveness of this intervention approach on both parents' and children's knowledge and perceptions of safety in vehicles and how children influence their parents' protective line of defense might more fully examine the importance of the child's influence on use and misuse of safety systems in vehicles.

The second issue that arises from this research is why parents' knew some of the necessary knowledge of safety seat use but not other important knowledge of safe use. This finding suggests that parents acquire knowledge of safety system use, but it is very limited. For example, most parents knew the correct weight for infants when transitioning from a rear facing to a forward facing car seat, but they were completely unaware that infants must remain rear facing until 12 months old in order to be safe. This finding may be a reflection of the success of prenatal education and the immediate post-partum information received in hospital settings. Infant car seats and forward facing CRD's for children up to 18 kilograms (40 pounds) are standard and required by law (Ontario Provincial Offences, 1999). However, the alarming finding in the study was the

fact that parents were less aware that infants must remain in a rear facing car seat until at least 12 months of age. Early research suggests that infants are transitioned out of rear facing seats at ages < 12 months of age, and that parents are unaware that 12 months of age is an important indicator of when a child has the strength in their neck to support their head in a forward facing seat (Snowdon, Patrick, Polgar & Stamler, in press). One possible explanation for parent's lack of knowledge of the importance of age when transitioning infants safely is that much of the prenatal education or discharge information in hospitals focuses only on newborns. Pre and post-natal education does not address safety seat use beyond infancy, and transitioning the infant at 12 months of age. Parents with newborns more than likely focus on the immediate safety needs of the infant and may have much less opportunity to access information on when to transition the infant safely to a forward facing seat. It is possible that information about safety seat use through the life span is much less accessible than prenatal and immediate postnatal information.

Clearly, the intervention program was effective in helping parents realize the importance of age, height and weight parameters in transitioning children from all of the different types of safety seats (rear to forward facing, forward facing to booster and booster to seat belt). However, parents' knowledge was only tested 6 to 8 weeks following the intervention. Longitudinal follow-up would be an important next step in this research in order to identify whether the significant increase in parents' knowledge remains stable at 6 months or longer following the intervention program. Future research that tests the effectiveness of the intervention over a longer duration of time would not only identify the longevity of parents' learning more adequately, but it might also

examine the ability of parents to use the learning materials as a resource throughout their child's growth and development phases.

In this study, the intervention not only increased parents' actual knowledge regarding transition times, but it also improved parents' confidence in their new knowledge of the correct height and weight parameters for safe transitions from one car seat safety system to the next. These findings carry significant implications, as it is more likely that parents will practice safe transitioning of children in car seat safety systems when they are confident in their knowledge of correct use. However, knowledge of correct use may not be predictive of actual correct use of safety seats and in particular, safe transitioning of children into safety seats as they grow and develop over time. Future research that identifies whether changes in parent knowledge actually influences correct use of safety seats has yet to be examined. Although the parents in this study demonstrated significant increases in knowledge it is not known whether correct use changed actual parent practices as a result of the increase in knowledge. Further research may include along with the education intervention program, an observational component of the program to observe parents placing children in safety seats. This additional observational component might yield important information relative to the relationship between parents' knowledge and parent's actual use of the knowledge in practice.

One compelling issue raised in this study was the sources of information parents reported using to learn about car seat safety systems. The majority of parents in this study reported that accessing information was easy. However, given that parents easily found safety seat information, it was remarkable how limited parents' knowledge of correct use was in the pre-test data. Clearly, this study identified that parent's sources of

information are limited in scope and detail. The majority of parents in this study most often sought non-professional sources of information regarding the use of car seats. Parents reported relying on instructions from the car seat box, and information passed on from family members and friends as their two primary sources of information. Instructions and illustrations on boxes offers only the most basic information for parents and offers very little, if any, information on when it is safe to transition a child to the next type of safety seat. Similarly, information obtained from family and friends is often very limited and may even lead to the perpetuation of misinformation as parents try to assist each other with decisions regarding safety seat use. Clearly, the use of instructions on the box and family and friends as resources is very consistent with parents' notion that information is easy to access. Although every safety seat comes with detailed instructions, research suggests that instructions are often too difficult to understand, and only 50% of parents actually attempt to even read the instructions (Block et al., 1998; Decina & Knoebl, 1997; Gaines et al., 1996; Huggins, 2003; Margolis et al., 1992; Wegner & Girasek, 2003). Despite the massive amounts of information available to parents on car seat safety (ie. brochures, pamphlets, and Internet websites), it is difficult to fully comprehend why parents don't seek information sources beyond the most basic information on packaging and from family and friends. Future research might offer further insights into how families seek health information and why safety seat information may or may not be easy to readily understand for the average parent.

Parents also reported using car seat clinics as a source of information. The primary focus of car seat clinics is installation. Although, this is an excellent source of information on how to install safety seats, it is very limited to the one moment in time

and does not focus on learning strategies for parents as children grow and develop over time. Future research needs to examine how parents learn safety seat use in car seat clinics and how additional resource information might be integrated into learning in safety seat clinics in order to offer parents accessible sources of accurate information, such as quick reference materials to parents regarding transition times. As well, future research needs to involve the parents in deciding what type of media works for them and what information tools will work for all socioeconomic and cultural groups, to ensure availability and accessibility is equitable.

The results of this research study definitely show that this type of multi-media intervention program impacted parental knowledge in a very positive manner. The multi-media intervention program was developed so that parents could have a reference library that they could refer to over time as the child grows and develops. Specifically, the fridge magnet and the car seat safety chart were designed for children of all ages, heights and weights. The fridge magnet and the car seat safety chart also provided simple, direct information about each type of safety seat that allowed parents easy access to very important transition information that parents can use anytime. The fridge magnet was very popular with the parent group in the study. Parents commented, "I have the magnet on the fridge", "hold on I will go get my fridge magnet", these responses were common among the parent participants during the telephone follow-up calls. This may suggest that parents used these learning materials in order to answer the post-test questions. However, it may also suggest that safety seat information may be too complex to readily commit to memory and perhaps memorizing the information is far less important than having quick accessible information that parents know how and when to use to keep their

children safe in vehicles. On numerous occasions, parents asked for extra car seat safety charts for their children and other family members, as well the staff at the Daycare Centres asked for extra car seat safety charts for their classrooms. Information that can be displayed and kept over time as a reference may be more beneficial than trying to have parents commit to learning solely by memory. This multi-media intervention was clearly very effective in increasing parental knowledge of safety system transitions and effectively increased their confidence in their new knowledge.

The sheer complexity of car seats, types of car seats, transition times, and children's growth and development patterns can make it frustrating and very confusing for parents to figure out how to effectively use safety seats as a child moves from one car seat safety system to the next. One of the issues these findings raise is the importance of varied learning strategies in supporting learning. The "Car Seat Safety Chart" and the "fridge magnet" were appropriate, quick references for parents to use as their child's height and weight changed over time. Education that focuses on finite ranges of information regarding safety information may be less effective, whereas information that "grows" with the child was found to be very effective in this study.

This study implemented the intervention program using a self-directed approach, whereas in the larger study a one-on-one approach was used with the participants. It is important to note that the self-directed approach used in this study involved much less invasive or direct contact with the participants, whereas in the larger study participants received one-on-one instruction. Despite the use of a self-directed approach in this study, parental knowledge increased dramatically similar to that of the larger study.

Future research needs to address the longevity of parent learning and how it translates

into patterns of correct use of car seat safety systems over time. It would be interesting and beneficial to follow a group of parents and their children over a designated period of time to see if knowledge is retained and if the knowledge is translated into the correct use. Further research should also examine the interaction of children participating in the intervention program parallel with the parents.

### *Limitations*

The results of this study are limited by the short nature of the post-test follow-up of 6 to 8 weeks. This particular study did not offer any longitudinal data to measure the longevity of knowledge retention. However, the multi-media intervention program impacted parents' knowledge in a positive manner.

This study did not measure decision making or actual use. Although, the intervention program accomplished a shift in knowledge, we do not know if it translates into decision making or actual correct use by the parent.

The study findings are limited as the intervention did not measure the children's learning. Whether or not the children's learning impacted the parent's knowledge was not directly measured.

The sample was very homogenous. The sample was largely a rural sample consisting of mostly Caucasians with a socio-economic status from \$60,000 to over \$80,000, with a college diploma or university degree level of education. This study did not capture ethnic and cultural groups, or lower income families, which restricts the representativeness of the sample and limits the projection of findings to a larger provincial audience (Polit & Hungler, 1999). As well, this study had a very small number of infants (n=2) reported on whereas the larger study had more infants and toddlers, and fewer school age children.



The intervention program was exactly the same for this study as for the larger study in Ontario with the difference in application of the intervention program. This study's procedure by the researcher was one of a more self-directed approach versus a one-on-one approach applied in the larger study. Both this study and the larger study had significant positive changes in parental knowledge levels.

### *Implications for Nursing Practice*

MVC's are the leading cause of death for children between the ages of 0 to 14 years old (Murphy, 1998; Zaza et al., 2001). MVC's are a major health risk for children, this is a "public health issue." A public health issue that requires attention and strategies to get the information and education out and into communities. This public health issue needs to be addressed, and nurse researchers are well-positioned to engage in research to develop, implement and evaluate educational programs within both the health care and education sectors. Health promotion and injury prevention are at the core of what nurses do, therefore nurses are well suited to participate in the design, implementation and evaluation of provincial campaigns and national campaigns to address vehicle safety for children.

Nurses need to advocate to public health agencies as well as public and separate school boards to bring education regarding vehicle safety into classroom curriculums. If anti-smoking education, sex education and healthy lifestyle education begins in public school, why not car seat safety? MVC's are the leading cause of death for children in North America, yet there are no public education systems or programs in place.

The issue of premature transitioning into incorrect car seats and seat belts puts the pediatric population at high risk for injury and even death. This is a message that needs to

be communicated to all health care professionals. Nurses and other health care professionals need to be much more aware of the importance of safety for children in vehicles. Education programs focusing on the topic of "Vehicle Safety for Children" needs to be developed by health care professionals, such as emergency room nurses, pediatric nurses, maternity nurses, public health nurses, physicians and allied health professionals so that education of vehicle safety becomes part of the daily health teaching routines.

This public health issue needs to be addressed by government officials at both the municipal and federal levels. Nurse researchers need to advocate for the children of Ontario communities to stress the importance of addressing this issue and to attain funding for further research. This study revealed that parents obtain the majority of information from the car seat box, the question that needs to be answered is why? Research projects that focus on needs assessments developed to find out what information is available, the accessibility of the information, and the ability of parents to understand the information are needed. This type of research can lead to the development of innovative strategies to get information to parents. For example, what about a Telehealth or a child vehicle safety hotline where parents can readily access consistent and up-to-date information on vehicle safety for children?

In this study, both of communities used for the intervention had car seat clinics running on a continual basis yet the study revealed that parents were knowledgeable about correct fit as defined as: straps being flat not twisted, buckles positioning, etc..., parents practiced correct location of their children when in car seats within the vehicle. However, there were high rates of incorrect use and lack of knowledge on appropriate

transition times. One may conclude that the availability of car seat clinics alone is not enough to support families' knowledge and decision making in utilizing effective and safe safety systems as the child grows and develops. Car Seat clinics need to be evaluated by nurse researchers and public health nurses to review what car seat clinics provide and see if there is an opportunity to add or change components of the clinics to incorporate more information and education for the parent and the child.

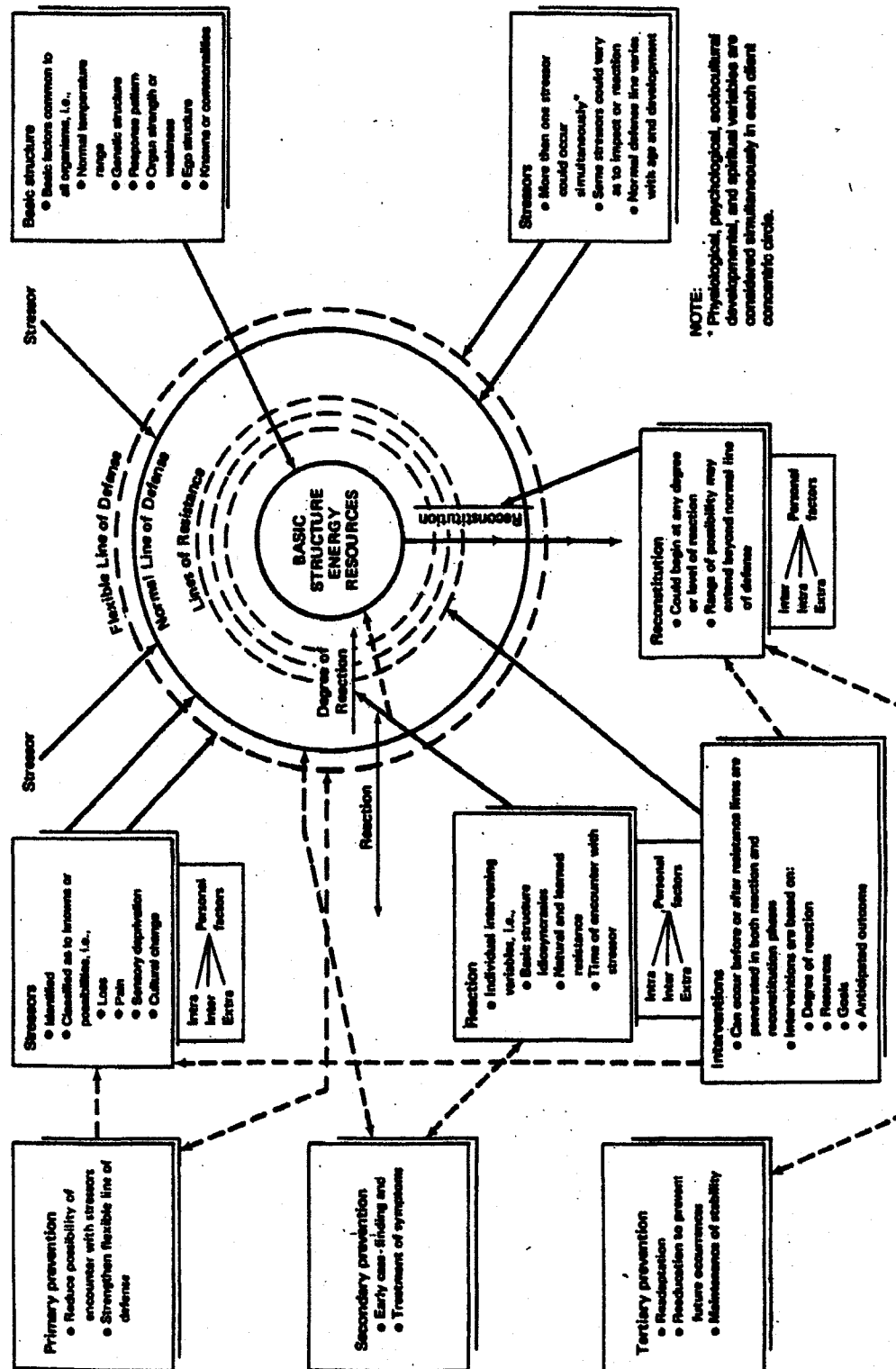
### *Summary*

Despite decades of advancement in vehicle safety and roadway infrastructure, MVC's continue to be the leading cause of death and serious injury among children 14 years and younger (Zaza et al., 2001). The World Health Organization (2004) is calling road traffic injury a public health problem. Today in North America, 80% of CRD's are not being used correctly, therefore children traveling in motor vehicles remain unprotected and susceptible to serious injuries and even death (Biagioli, 2002; Weber, 2000). As children grow and develop, fewer are appropriately restrained when riding in motor vehicles (Bull et al., 2002; Weber 2002; Winston, Durbin, Kallan & Moll, 2000). This study suggests that the toddler and school age groups are at risk for injury and even death due to the fact that parents are prematurely transitioning children into the incorrect child car seat system or adult seat belt system. It's time to take this "public health problem" and give it the attention and time it deserves to find a treatment or a cure.

Health care professionals have an important role in health promotion in preventing serious and fatal injuries in the pediatric population, one of the key steps is understanding the magnitude of the risk. "Examination of factors associated with vehicular trauma and its prevention or reduction are important research and public health issues" (Sahai,

Pitbkido, Bota & Rowe, 1998, p. 320). After all “riding in a motor vehicle is the most dangerous thing children can do” (McKay, 2003, p. 8).

# Appendix A: Neumans System Theory Model



## Appendix B: Average Height and Weight Measurements for Young Children

*Average Height and Weight Measurements for Young Children*

	Males		Females	
	Height	Weight	Height	Weight
Age 4	101.25 cm 40.5 in.	16.7 kg 36.75 lb	100.0 cm 40.0 in.	16.0 kg 35.25 lb
Age 5	108.1 cm 43.25 in.	18.75 kg 41.25 lb	106.9 cm 42.75 in.	17.72 kg 39.0 lb
Age 6	114.4 cm 45.75 in.	20.68 kg 45.5 lb	112.5 cm 45.0 in.	19.55 kg 43.0 lb
Age 7	120.0 cm 48.0 in.	22.84 kg 50.25 lb	118.8 cm 47.5 in.	21.93 kg 48.25 lb
Age 8	125.0 cm 50.0 in.	25.34 kg 55.75 lb	124.4 cm 49.75 lb	24.89kg 54.75 lb
Age 9	130.0 cm 52.0 in.	28.18 kg 62.0 lb	130.0 cm 52.0 in.	28.52 kg 62.75 lb
Age 10	135.6 cm 54.25 in.	31.47 kg 69.25 lb	136.3 cm 54.5 in.	32.61 kg 71.75 lb
Age 11	141.25 cm 56.5 in.	35.34 kg 77.75 lb	142.5 cm 57.0 in	37.05 kg 81.5 lb
Age 12	147.5 cm 59.0 in	39.89 kg 87.75 lb	149.4 cm 59.75 in.	41.59 kg 91.5 lb

Note. Average measurements=fiftieth percentile. Age noted in years. Adapted from *Whaley & Wong's Nursing Care of Infants and Children* (5<sup>th</sup> ed.). St. Louis: Mosby.

Appendix C: Poster Display

**INFORMATION THAT COULD  
SAVE YOUR CHILD'S LIFE**

**“Looking for parents to participate in  
a research study”**

**VEHICLE SAFETY FOR CHILDREN**

**Dates:**

**Location:**

**Several mini information sessions on  
vehicle safety for children will be  
presented on each day**

**Please take a few minutes to stop by and  
participate – Thank-you**

## Appendix D

## Information Letter

My name is Lisa High. I am a nursing student at the University of Windsor conducting this research for my Master's degree. The purpose of this letter is to inform you about a research study to explore the knowledge base of parents with children who ride in motor vehicles. This research study is part of a larger research study which is being supported by the AUTO 21 Initiative. AUTO 21 is a national research initiative supported by the Government of Canada through the Network Excellence Directorate and more than 110 industry, government and institutional partners. AUTO 21 was formed to focus on the enhancement and improvement of vehicle safety in the 21<sup>st</sup> century.

One of the major health risks for children in Ontario is motor vehicle trauma and the leading cause of death of children is injuries resulting from motor vehicle crashes. Although, there are many programs and information for parents regarding child car seat safety, we are still putting our children in danger when riding in motor vehicles.

Appropriate child car seat safety includes: the correct seat for the child, the correct fit of the child in the car seat and the correct location of the car seat in the motor vehicle. As parents we assume we are using the correct seat, fitting the child correctly in the seat as well as placing the seat in the correct location to provide a safe environment for our child. Research tells us that we are not doing this very well, for example, we are using seats too small or too large for our children, we are not doing up buckles, straps and belts up properly, we are placing seats in the wrong area of the vehicle, and we are putting our children into adult seat belts much too earlier.

This research study will provide an opportunity to the parents who choose to participate to learn about the key factors of appropriate use. Participation in this research study is completely voluntary and presents no risk to you personally nor your child or children.

This information will increase the knowledge base of those in the health care field as well as the automotive industry in working with Paediatric populations and will assist in providing best practice information to parents. The research findings of this study will be used for in a larger provincial/national longitudinal study.

I am encouraging all parents to participate in this research. If you have any questions or concerns please feel free to contact me at (519) 354-5614.

Respectfully,

Lisa High



**Section 1: Use of Infant and Child Car Seats**

Please answer the following questions based on the situations described below.

**Situation One:**

One of your friends calls you to ask when their infant should be moved from a **Rear Facing Infant Seat** (see Pictures 1 and 2) to a **Forward Facing Child Seat** either Toddler or Convertible (see Pictures 3, 4, 5, 6 and 7).

1) At what age, height and weight should you tell your friend to move their infant to the larger **Forward Facing Seat**? Please be as specific as possible.

- a) Age \_\_\_\_\_ months
- b) Height \_\_\_\_\_ inches or centimetres (circle one)
- c) Weight \_\_\_\_\_ pounds or kilograms (circle one)

2) Please rate how confident are you with the responses you gave to your friend by circling one number.

Not Confident 1	2	3	4	5	6	7	8	9	Very Confident 10
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3) Please rank (as 1, 2, or 3) which is the most important factor when deciding when a child is ready to move to a Forward Facing seat. Please use #1 as the most important and #3 as least important.

\_\_\_\_\_ Age \_\_\_\_\_ Height \_\_\_\_\_ Weight \_\_\_\_\_ Other \_\_\_\_\_

4) Your friend then asks you what is the next type of safety restraint after a Forward Facing Child Seat?

- You tell your friend: ☐ Use a Booster Seat (proceed to Situation 2)  
☐ Use a Seat Belt only (proceed to Situation 3)

**Situation Two:**

One of your family members thinks that it may be time to move their child from a **Forward Facing Child Seat** (see Pictures 3 to 7) into a **Booster Seat** (see Pictures 8, 9, 10 and 11) and asks you when it is safe to do this.

1) At what age, height and weight do you tell your family member that they can move their child to a **Booster Seat**? Please be as specific as possible.

- a) Age \_\_\_\_\_ years and months
- b) Height \_\_\_\_\_ feet/inches or centimetres (circle one)
- c) Weight \_\_\_\_\_ pounds or kilograms (circle one)

2) Please rate how confident you are with the responses you gave to your family member by circling one number.

Not Confident 1	2	3	4	5	6	7	8	9	Very Confident 10
--------------------	---	---	---	---	---	---	---	---	----------------------

3) Please rank (as 1, 2, or 3) which is the most important factor when deciding when a child is ready to move to a Booster Seat. Please use #1 as the most important and #3 as least important.

\_\_\_\_\_ Age \_\_\_\_\_ Height \_\_\_\_\_ Weight \_\_\_\_\_ Other \_\_\_\_\_

**Please proceed to Situation 3 on the back of this page.**

**Situation 3:**

Your child is asking you when he/she can use a **Seat Belt only** when riding in vehicles (see Picture 12).

1) At what age, height, and weight do you think your child should be using a **Seat Belt only**? Please be as specific as possible.

a) Age \_\_\_\_\_ years and months

b) Height \_\_\_\_\_ feet/inches or centimetres (circle one)

c) Weight \_\_\_\_\_ pounds or kilograms (circle one)

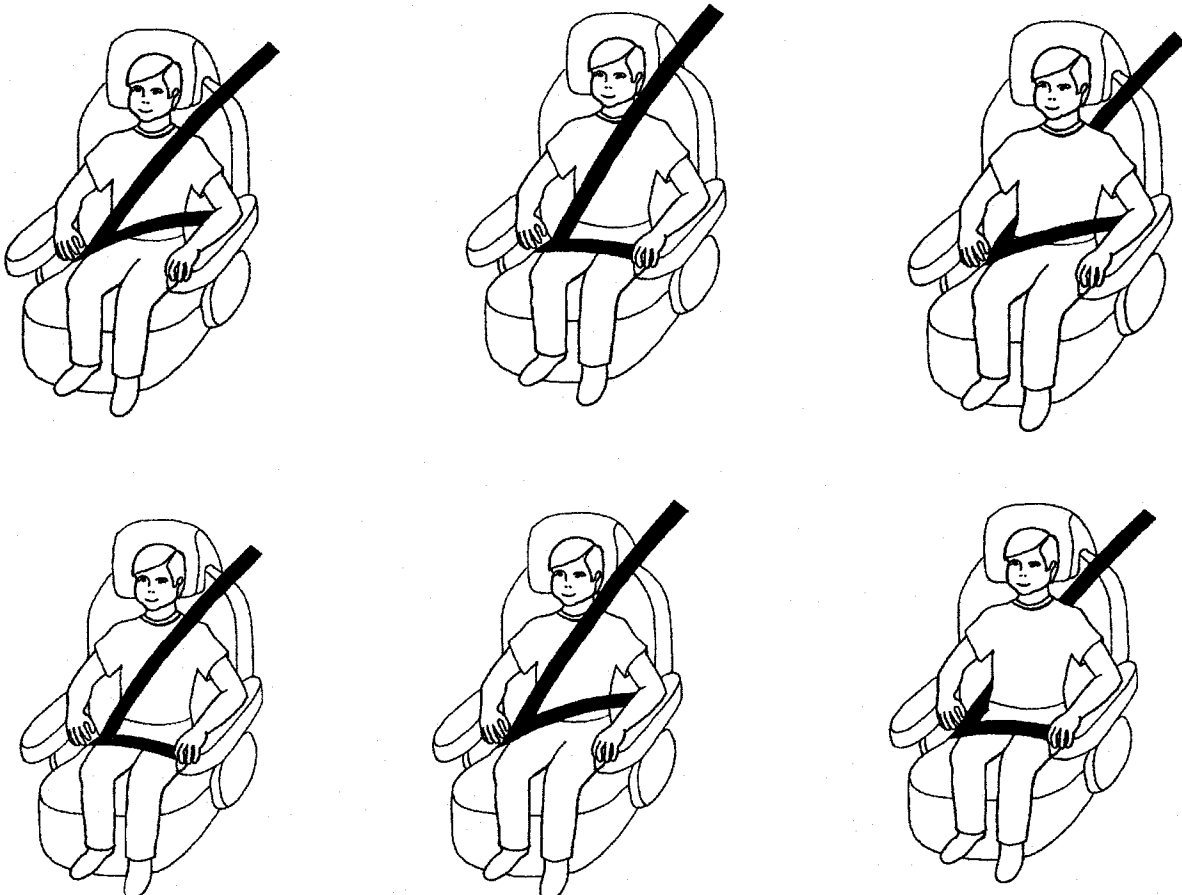
2) Please rate how confident you are with the responses you gave by circling one number.

Not Confident 1	2	3	4	5	6	7	8	9	Very Confident 10
--------------------	---	---	---	---	---	---	---	---	----------------------

3) Please rank (as 1, 2, or 3) which is the most important factor when deciding when a child is ready to use a **Seat Belt only**. Please use #1 as the most important and #3 as least important.

\_\_\_\_\_ Age \_\_\_\_\_ Height \_\_\_\_\_ Weight \_\_\_\_\_ Other \_\_\_\_\_

4. Please circle the illustration that shows the proper position of a seat belt on a child's body.



## Section 2: Your Personal Experience of Car Seat Use

**Instructions:** This section includes questions about the car seats that you are currently using for each of your children. We want to know when each of your children was moved from one car seat to another and why you made that move. We have provided space for you to answer these questions for your three youngest children. Pages 5-6 are to be answered keeping in mind your youngest child, pages 7-8 keeping in mind your next oldest child and pages 9-10 keeping in mind your oldest child.

### CHILD A (Youngest)

1. What is your child's date of birth? (month/day/year) \_\_\_\_\_
2. What sex is your child? ☐ Male ☐ Female
3. What is your child's current height and weight? Please circle the unit of measurement your answer is in.  
Height: \_\_\_\_\_ feet or metres & \_\_\_\_\_ inches or centimetres      Weight: \_\_\_\_\_ pounds or kilograms
4. Please indicate the way in which your child's car seat is now being used. (Check one box only)  
☐ Rear Facing      ☐ Forward Facing      ☐ Booster      ☐ Seatbelt only

If your child is using a Booster Seat or a Seat Belt only please skip to Qu. 7 on the back of this page.  
If your child is using a Rear Facing or Forward Facing Seat please proceed to the next Question.

5. For Rear Facing and Forward Facing Car Seats Only: The following statements concern the ease of installing the car seat in your vehicle. Please circle one number on the 6-point scale for each statement.

	Does Not Apply	Very Difficult	Difficult	Moderate	Easy	Very Easy
Positioning the car seat properly	0	1	2	3	4	5
Threading the seat belt through the slot in the rear of the car seat	0	1	2	3	4	5
Tightening the seatbelt	0	1	2	3	4	5
Tightening the tether strap	0	1	2	3	4	5
Placing the child in the car seat	0	1	2	3	4	5
Positioning the harness or straps on the child	0	1	2	3	4	5

**Instructions:** If your child is using a Rear Facing Seat please skip to Question 7 on the next page.  
If your child is using a Forward Facing Seat please proceed to Question 6.

6. For Forward Facing Seats Only: If you are unsure what a tether strap is please refer to Picture 3 on Page 1.

The tether strap is used... (Circle one)	Never	Rarely	Sometimes	Often	Always
--	-------	--------	-----------	-------	--------

If the tether strap is **not always** being used please indicate the reasons. (You may check more than one reason.)

- ☐ Don't know what a tether strap is
- ☐ Don't think the tether strap is important to use
- ☐ Don't know how to use the tether strap.
- ☐ The vehicle does not have an anchor for the tether strap.
- ☐ The car seat is moved from one vehicle to another. How many times per week is the seat moved? \_\_\_\_\_
- ☐ Other (please specify) \_\_\_\_\_

(Over)

For questions 7-10, please try to think back to the time when Child A was moved into the current car seat or when the direction of the car seat was changed. For some of you, this may have occurred several years ago and we realize it may be difficult to answer. Please answer the questions to the best of your ability. **Please note: If your child's car seat is Rear Facing please proceed to Question 11.**

7. The most recent change in my child's car seat was:

- ☐ Rear Facing to Forward Facing
 ☐ Forward Facing to a Booster Seat  
☐ Forward Facing to a Seatbelt only
 ☐ Booster Seat to a Seatbelt only

8. What was your child's age and weight when this move occurred?

Age: \_\_\_\_\_ years & \_\_\_\_\_ months      Weight: \_\_\_\_\_ pounds or kilograms (circle one)

9. We are interested in how confident you are about the age and weight you gave in question 8. Using the Confidence Scale below please indicate one number for each of the following:

Age: Confidence Level \_\_\_\_\_      Weight: Confidence Level \_\_\_\_\_

Not Confident 1	2	3	4	5	6	7	8	9	Very Confident 10
--------------------	---	---	---	---	---	---	---	---	----------------------

10. Please indicate how **important** the following reasons were for deciding when deciding to make this move. If you never thought of a particular reason, please circle the 0 in the column labelled Not Considered. Otherwise please circle one number on the 1 to 5 scale for each statement.

	Not Considered	Not Important	A Little Important	Somewhat Important	Fairly Important	Very Important
Child's weight	0	1	2	3	4	5
Child did not like old car seat	0	1	2	3	4	5
Child no longer appeared to fit in the car seat	0	1	2	3	4	5
Child's age	0	1	2	3	4	5
The car seat was required by another child	0	1	2	3	4	5
Child's height	0	1	2	3	4	5

11. My child uses a safety seat... (Circle one)

Never	Rarely	Sometimes	Often	Always
-------	--------	-----------	-------	--------

If the safety seat is **not always** being used, please indicate the reasons (you may check more than one):

- ☐ When transported by people other than his/her parents
 ☐ On short trips in the city  
☐ On short trips in the neighbourhood
 ☐ On the highway  
☐ When using another family vehicle
 ☐ Child uses a seat belt  
☐ Other \_\_\_\_\_

12. Instructions: If your child is 4 year old or older please answer this question.

Do you **own** a Booster Seat for Child A? ☐ No ☐ Yes

If Yes, is Child A **currently using** the Booster Seat? ☐ No ☐ Yes

If it is not being **used**, please indicate the reasons (you may check more than one).

- ☐ The child is not big enough to use it
 ☐ The child has used it but is now ready to use a seatbelt only  
☐ The child should be using it but refuses
 ☐ The seat belt does not fasten properly when the seat is used  
☐ Other \_\_\_\_\_

**If you have another child please proceed to the next page. If not, please go to Page 11.**

**Section 3: Location Of Your Children In Your Vehicle.**

### Section 3: Location Of Your Children In Your Vehicle

The following questions will help determine where children sit in vehicles and what type of vehicles parents are driving.

1. In what type of vehicle do you most often transport your children?

- ☐ Sedan (4 door)      ☐ Coupe (2 door)      ☐ Minivan      ☐ SUV (Sport Utility Vehicle)  
☐ Pick-Up Truck      ☐ Station Wagon      ☐ Other \_\_\_\_\_

2. What is the make and model of this vehicle? \_\_\_\_\_

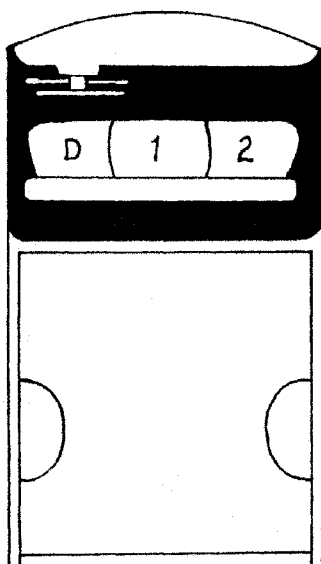
3. What year was this vehicle made? \_\_\_\_\_

4. Does your vehicle have airbags? ☐ No ☐ Yes

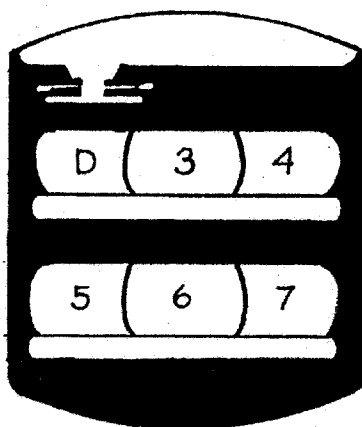
If Yes, does your vehicle have: ☐ Driver air bags only      ☐ Driver and front passenger air bags only  
☐ Driver, front passenger and side impact air bags

5. The pictures below (under the Roman Numerals) represent different types of vehicles based on the number of rows of seats. Please circle the picture below (I, II, or III) that corresponds to your vehicle.

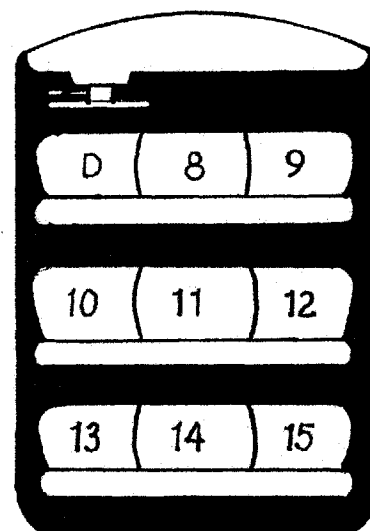
I



II



III



6. On the pictures above, each seat position is labelled with a number. Vehicles often differ in the number of seats per row. On the picture you chose, please indicate which seats your vehicle is missing by placing an X through the corresponding position on the picture. For example, if your vehicle is missing the middle front seat place an X through the Number 1, 3, or 8 depending on which picture you circled.

7. Now, please indicate where each of your children usually sits in the vehicle by choosing the number of the seat in which each child sits. Child A, B, and C should refer to the same children as in the previous sections.

Child A is in Seat # \_\_\_\_\_ Child B is in Seat # \_\_\_\_\_ Child C is in Seat # \_\_\_\_\_

Please proceed to question 8 on the back of this page.

8. The following questions are to be answered for each of your children. Please use Child A, B, and C to refer to the same children as in previous sections.

**Child A (Youngest)**

My child sits in the front seat...(Circle one)	Never	Rarely	Sometimes	Often	Always
--	-------	--------	-----------	-------	--------

If there are times when **Child A** does sit in the front seat, please indicate the reasons. You may check more than one reason.

- ☐ My vehicle has only one row of seats.
- ☐ My child won't sit anywhere else.
- ☐ My child sits in the front seat when I transport a lot of people.
- ☐ I let my child sit in the front seat as a reward.
- ☐ I like having my child sitting next to me.
- ☐ Other \_\_\_\_\_

**Child B (Middle)**

My child sits in the front seat...(Circle one)	Never	Rarely	Sometimes	Often	Always
--	-------	--------	-----------	-------	--------

If there are times when **Child B** does sit in the front seat, please indicate the reasons. You may check more than one reason.

- ☐ My vehicle has only one row of seats.
- ☐ My child won't sit anywhere else.
- ☐ My child sits in the front seat when I transport a lot of people.
- ☐ I let my child sit in the front seat as a reward.
- ☐ I like having my child sitting next to me.
- ☐ Other \_\_\_\_\_

**Child C (Oldest)**

My child sits in the front seat...(Circle one)	Never	Rarely	Sometimes	Often	Always
--	-------	--------	-----------	-------	--------

If there are times when **Child C** does sit in the front seat, please indicate the reasons. You may check more than one reason.

- ☐ My vehicle has only one row of seats.
- ☐ My child won't sit anywhere else.
- ☐ My child sits in the front seat when I transport a lot of people.
- ☐ I let my child sit in the front seat as a reward.
- ☐ I like having my child sitting next to me.
- ☐ Other \_\_\_\_\_

**Section 4: Sources of Information**

1. Did you receive any information regarding the safe use of car seats prior to the purchase/loan of your car seat? If so, where did you acquire this information? Please check all that apply.

- ☐ Family or friends
- ☐ Car Seat Clinic
- ☐ Internet
- ☐ Pamphlets or magazines
- ☐ Hospital
- ☐ Prenatal classes
- ☐ Family doctor, paediatrician, public health nurse etc.
- ☐ Instructions on the box the seat comes in
- ☐ Other \_\_\_\_\_

2. Please indicate on the scale below how easy it was for you to find information about the safe use of car seats.

Very Difficult 1	Difficult 2	Moderate 3	Easy 4	Very Easy 5
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Please proceed to Section 5 on the next page.

## Section 5: Parent or Caregiver Information

1. Today's date (month/day/year) \_\_\_\_\_
2. Your Age: \_\_\_\_\_
3. Sex: ☐ Male ☐ Female
4. Relationship to child: ☐ Mother ☐ Father ☐ Guardian ☐ Grandparent ☐ Other \_\_\_\_\_
5. Marital status: ☐ Single ☐ Married/Common Law ☐ Separated/Divorced ☐ Widowed
6. Country of Birth \_\_\_\_\_  
 If you were not born in Canada, how many years have you lived here? \_\_\_\_\_
7. Do you live in a: ☐ Large city over 300,000 people  
☐ Large city between 100,000 and 300,000 people  
☐ Large town or city between 30,000 and 100,000 people  
☐ Small town between 1,000 and 30,000 people  
☐ Rural area less than 1,000
8. Yearly Household Income: ☐ under \$20,000  
☐ \$20,001-40,000  
☐ \$40,001-60,000  
☐ \$60,001-\$80,000  
☐ Over \$80,000
9. Highest level of education completed: ☐ Grade school  
☐ Some High School  
☐ High School Graduate  
☐ Some post-high school  
☐ College Diploma/ Certificate  
☐ University Degree
10. How many years have you been driving? \_\_\_\_\_
11. Did you receive your driver training in Canada? ☐ No ☐ Yes  
 If No, where was it received? \_\_\_\_\_
12. How many children do you have currently using child car seats? \_\_\_\_\_
13. How many children do you have currently using booster seats? \_\_\_\_\_
14. How many children do you have currently using seatbelts only? \_\_\_\_\_
15. How many times per week do you transport the child?  
☐ less than once a week ☐ once per week ☐ two to three times per week  
☐ four to six times per week ☐ every day

**Thank you for completing this survey.**

**Appendix F**  
**Car Seat Quiz**

**Is your child safe when riding in your motor vehicle?**

**Take our car safety quiz to see if your child is safe. Circle the correct answer.**

- 1) How should the belts and/or straps of the child car seat be situated on the child's body?
  - (a) twisted
  - (b) flat
  
- 2) Which statement is false?
  - (a) a lap belt should fit snug and low on the child's thighs, not across the child's stomach
  - (b) it is okay to tuck the shoulder belt under your child's arm or behind your child's back so that is not across the child's stomach
  - (c) side air bags can be dangerous to children sitting next to them
  - (d) you should not use a car seat that is more than 10 years old
  
- 3) Once a car seat has been installed what is the most it should wiggle?
  - (a) ½ inch
  - (b) 1 inch
  - (c) 1 1/2 inch
  - (d) 2 inches
  
- 4) Where should a harness chest clip be positioned?
  - (a) near your child's neck
  - (b) at the level of the child's underarms
  - (c) over the child's belly
  - (d) near the child's waist
  
- 5) When a child is using a Booster Seat, the following statement is true.
  - (a) child's weight should be 20 pounds and 32 inches
  - (b) child's age should be 2 years old
  - (c) child's weight should be 40 pounds to 80 pounds
  - (d) child's ears should be several inches below the top of the booster seat
  
- 6) Harness straps should fit
  - (a) snug and tight allowing one finger between the strap
  - (b) loosely so your child can get out of the car seat easily
  - (c) below your child's shoulders under the underarms
  - (d) snug, but with at least 2 to 3 inches of slack



- 7) When using a forward facing seat, the harness straps should be located.
- (a) at or slightly below your child's shoulders
  - (b) at or slightly above your child's shoulders using the top set of harness slot
  - (c) below your child's shoulders
  - (d) none of the above
- 8) When will child be ready to wear an adult seat belt?
- (a) when your child is 5 years old
  - (b) when your child weighs 60 pounds and reaches a sitting height of 28 inches
  - (c) when your child is 8 years old
  - (d) when your child weighs 80 pounds and reaches a sitting height of 29 inches
- 9) Where should a 25 pound - 20 inch tall child ride in the car?
- (a) in a forward facing toddler seat in the back seat
  - (b) in a rear facing convertible seat in the back seat
  - (c) in a rear facing infant seat in the front seat, as long as there is an air bag
  - (d) in a booster seat in the back seat
- 10) Where is the safest place for a child who weighs 50 pounds and is 43 inches tall to sit in a car?
- (a) in the front seat, as long as there is an air bag
  - (b) in seat belts in the back seat
  - (c) in a booster seat in the back seat
  - (d) in the front seat, as long as there is not an air bag
- 11) How do you know if your child is secured safely in you motor vehicle?

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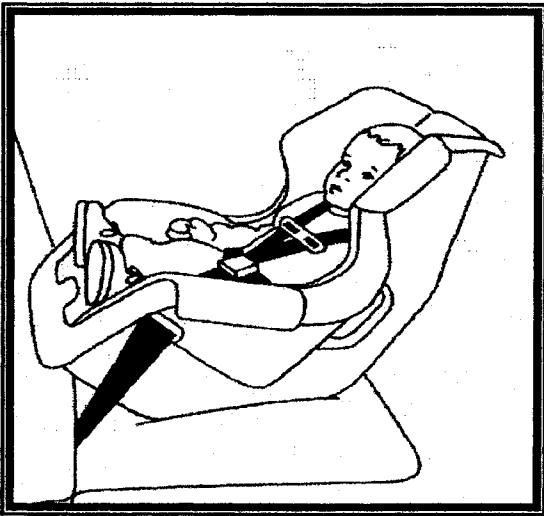


Figure 1A. Rear Facing Convertible

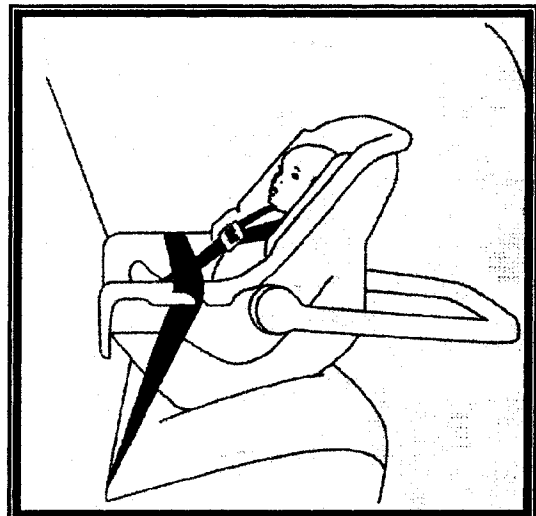


Figure 1B. Rear Facing Only

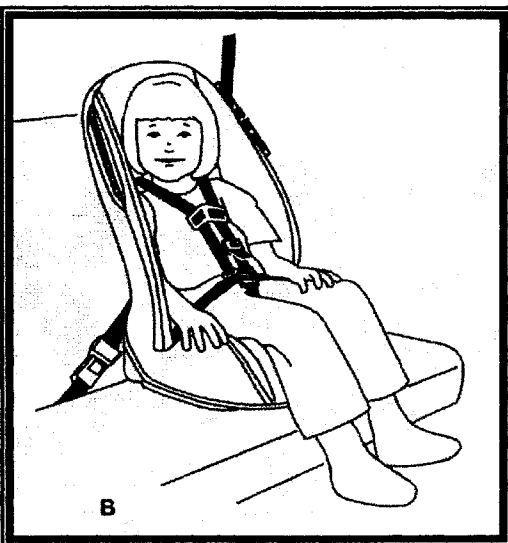


Figure 2A. Combination Child Seat and  
Booster

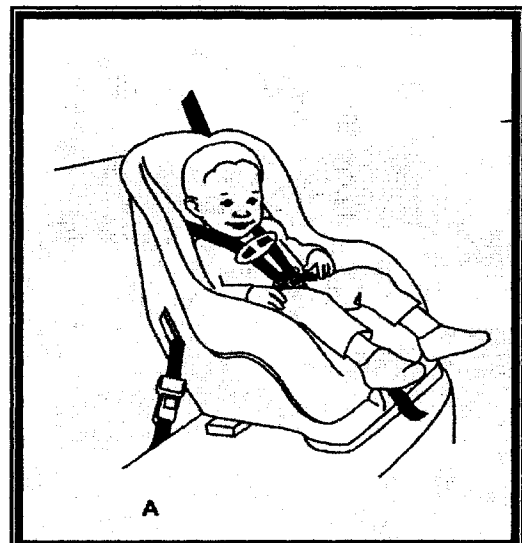
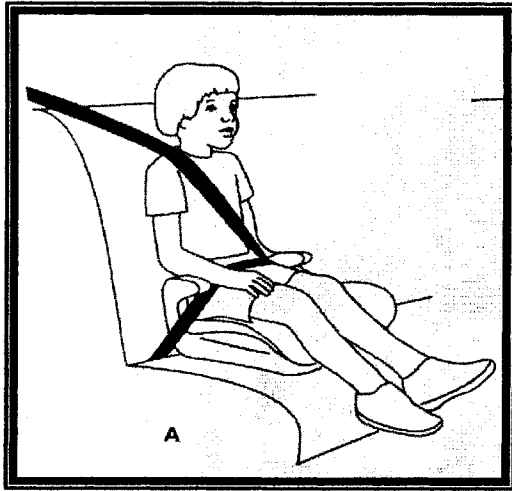
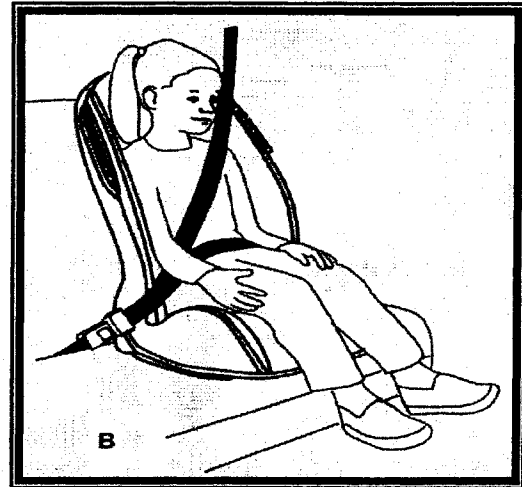


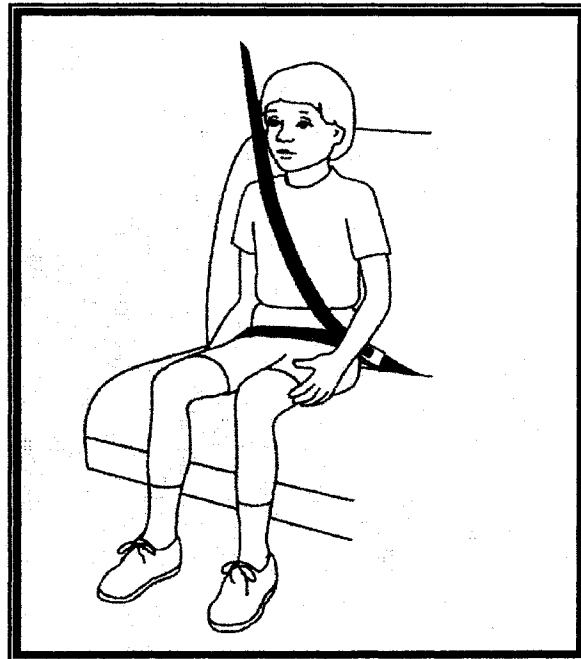
Figure 2B. Forward Facing Convertible



**Figure 3A. Low Back Booster**



**Figure 3B. High Back Booster**



**Figure 4. Vehicle Seat Belt**

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